In Circuit Scope Plus (ICS++　W1004) User's manual

Real time variable waveform viewer

In Circuit Scope Plus is the tool which shows the waveform of the global variables running on the target CPU.

This manual shows how to use "In Circuit Scope plus"

※Caution

November 1, 2014 now, conventional ICS board is not able to drive by the new ICS++ PC software. However, target side conventional library can be use in the new ICS++ system.

Target CPU devices

ICS system is working on following devices.

○16bit　devices：

RL78/G1F, RL78/G14, RL78/F14, RL78/F13, RL78/G12, RL78/G13, 78K0RIC3, 78K0R/ID3, 78K0R/IE3

○32bit　interger type devices：

RX111, RX210, RX220, V850/IA3, V850/IA4, V850E2/IG3, V850E/FJ3, SH7047, SH7146, SH7149, SH7237,

○32bit floating point support type devices：

RX23T, RX62T, RX63T, RX631, RX64M, RX71M, V850E2M/FJ4, V850E2/ML4, SH7216, SH7239,

For more information about support for other devices, please contact DESK TOP LABORATORIES INC. http://desktoplab.co.jp　With the development of target-side library, ICS system can work on more than 16bit of RENESAS Electronics devices.

About｜ICS/ICS++

ICS is the product of the Renesas Electronics Corporation. Desk Top Laboratories Inc supports how to use ICS system and the development of the ICS target libraries.　ICS++ is the product of the Desk Top Laboratories Inc.

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1. Summary

1.1 Summary

In Circuit Scope Plus is a real time debugging tool for the Power Electronics.

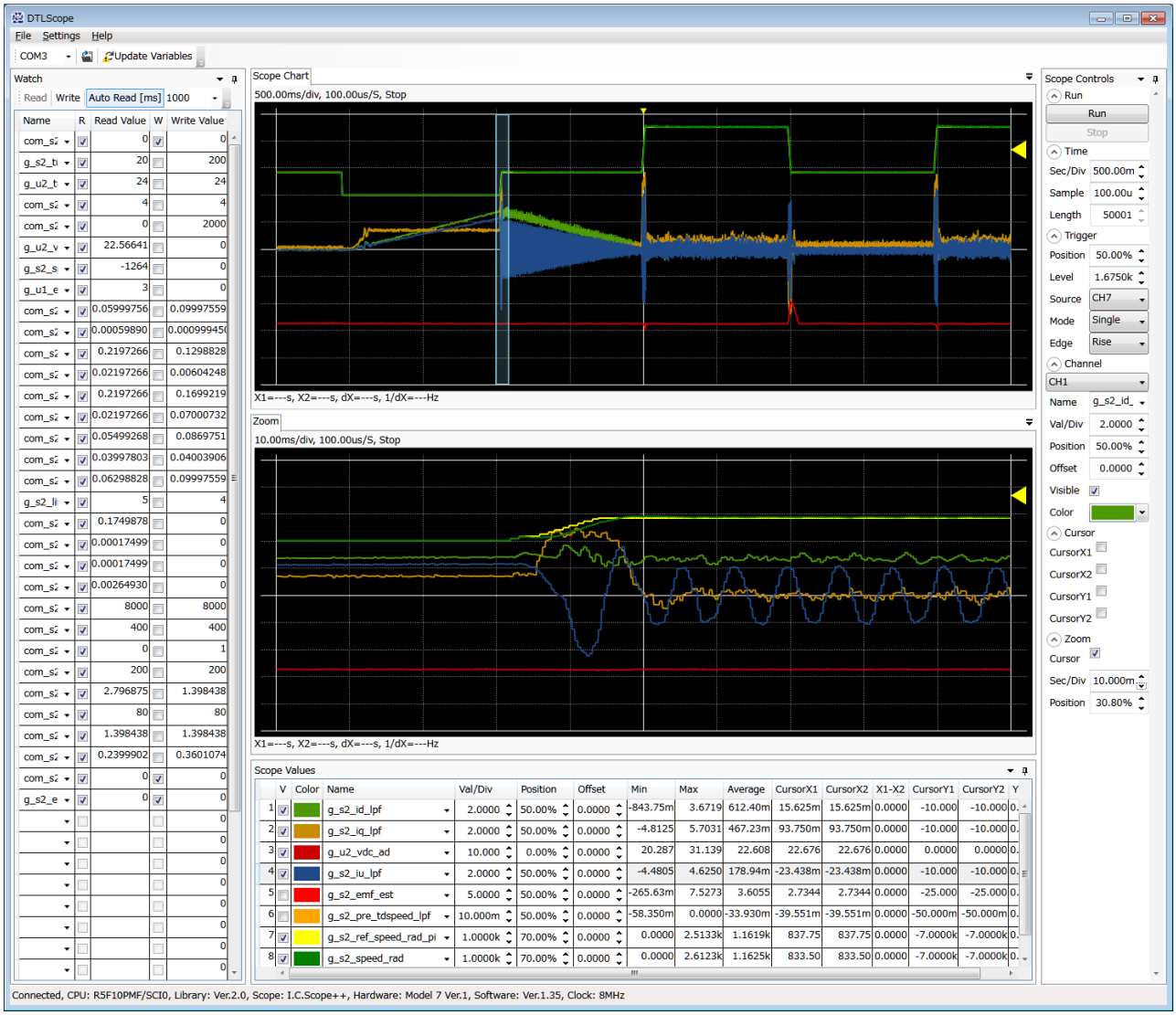


図 1-1 ICS++ PC software appearance

1.2 Features

ICS++ is possible for following operations on a global variables.

(1) ICS++ is possible to display a waveform in real time.

(2) ICS++ can be used just same as oscilloscope.

(3) ICS++ is possible to adjust the gain of the control software by writing any value to global variables during program executing.

(4) ICS++ has a function just like function generator. So ICS++ can generate operation pattern. (Planning OPTION)

(5) ICS++ can save the recorded data. So it is possible to use as a data logger. (Planning OPTION)

(6) Frequency analysis function (Planning OPTION)

1.3 Connection

Connect to a PC from the target processor via the ICS++ unit. Please refer to the Section 3.1 “flow of the use”. In addition, please refer to Chapter 4 regarding ICS++ unit.

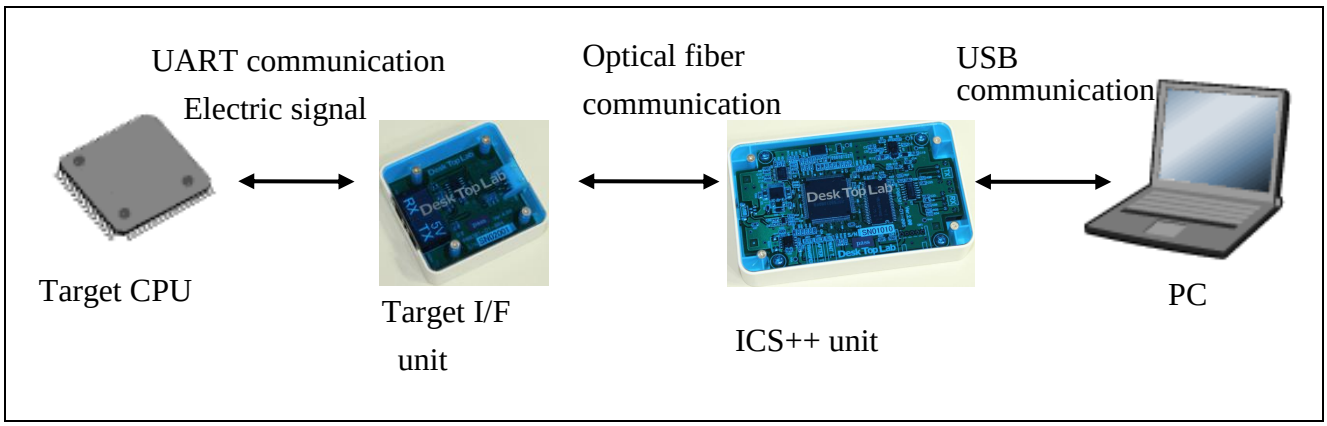


図 1-2 Hardware configuration

1.4 Software configuration

Based on the variable names and memory address information, ICS++ processes the data to be transmitted via the ICS unit from the target CPU, to display the waveform on the PC.

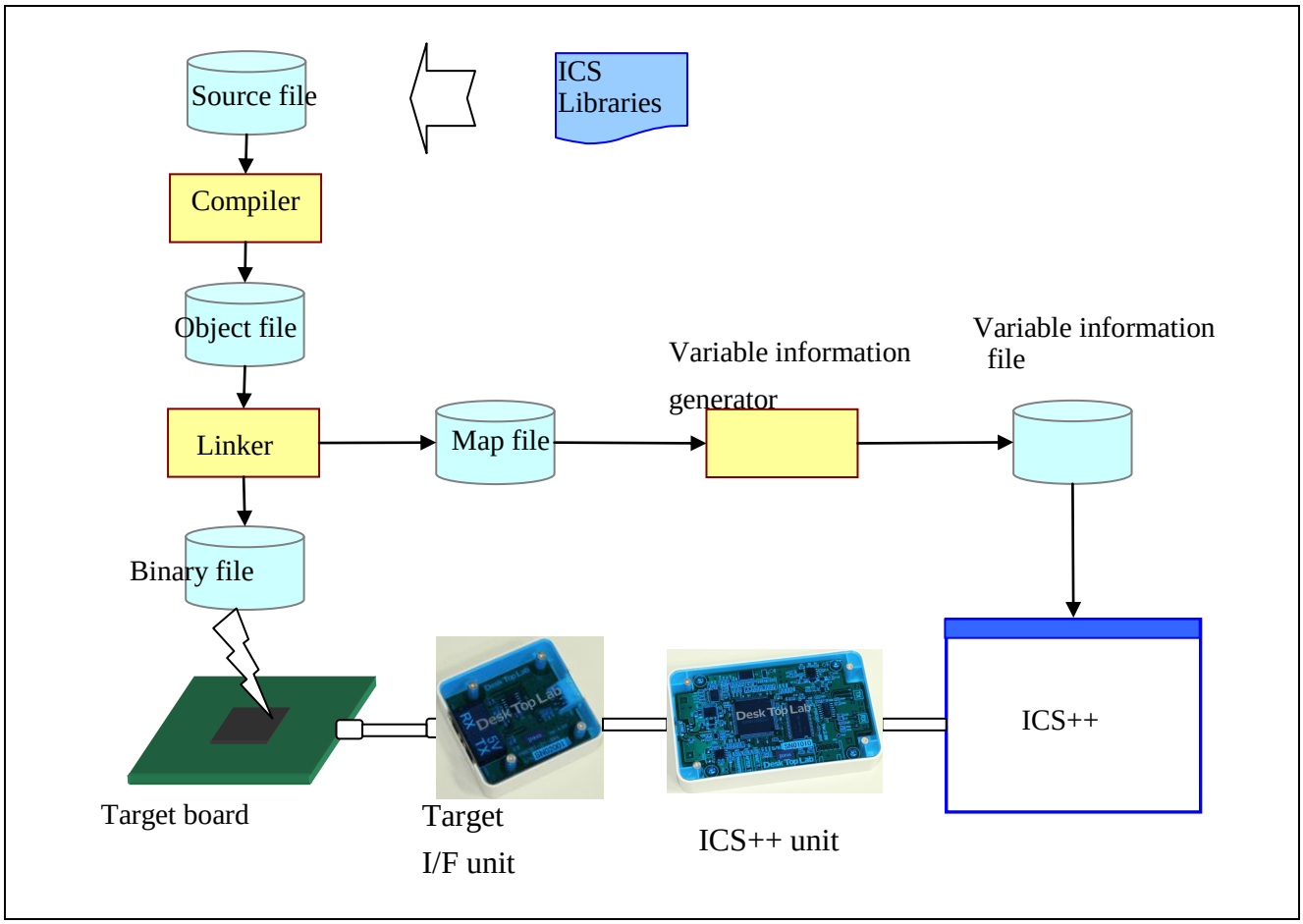


図 1-3 Software configuration

2. ICS++ specifications

2.1 Product configuration

This product contains the following parts and units.

Table 2-1 Product configuration

No.	Item	
1	In Circuit Scope Plus unit	1
2	Target I/F unit (for 5V CPU)	1
3	Target I/F unit (for 3.3V CPU)	1
4	Optical fiber 2m	2
5	USB cable	1
6	Target I/F cable 1 single side XHP-4	1
7	Target I/F cable 2 both side XHP-4 （From 2014/12/19）	1
(8)	USB memory	1

2.2 Operating environment

Specifications required in order to install the ICS++ is shown below. But we recommend high specification PC.

Waveform refresh rate depends on PC specifications.

Table 2-2 Operating environment

No.	Item	Specifications
1	PC	Free disk space: more than 100MByte RAM: more than 1GByte USB port : 1 [channel](USB2.0) .Net framework client 4.5 installed
2	OS	Windows Vista 32bit, Windows 7 32bit / 64bit *Windows 8 32bit / 64bit Windows 8/8.1 requires a special install procedure to install software.

2.3 Tool specifications

The specifications summary list of ICS++

Table 2-3 ICS++ specification summary

Item	Specifications
Measurement period	It depends on the library installed in the target CPU.
Waveform measurement channel	Max 8 channel It depends on the ICS unit model.
Measurement variable type	It depends on the library installed in the target CPU.
Trigger mode	Single / Auto / Normal
Trigger source	Input channel (8 channel)
Numeric display channel number	Max 48 variables
Data management	Save and Load function of the waveform data
Waveform display screen	Main screen + Zoom screen
Occupied UART port	TXD, RXD
Occupied peripheral function	UART 1 channel, DMA or DTC, (FIFO)
Support CPU	16bit RL78G14, RL78F14, RL78G1F, RL78G12, RL78G13, 78K0R/Ix3 32bit RX62T, RX63T, RX64M, V850E2M/FJ4, V850E2/ML4, SH7216, SH7239

	32bit RX111, RX210, RX220, V850E2/IG3, SH7047, SH7146, SH7149, SH7237 Most of the 16/32bit Renesas CPU can use ICS function. Please contact Desk Top Laboratories Inc for specific CPU support. December 1, 2014, RL78G1G can not be use and has been confirmed.

3. How to use ICS++

3.1 Flow of use

When using ICS++, please prepare the order of (1) to (9).

(1) Connect ICS++ unit and the target CPU board （Please refer Chapter 4）
(2) Connect ICS++ unit and the PC via USB cable.
(3) Supply power to the target board.
(4) Download the user program to the target CPU board.
(5) Execute program
(6) Start ICS++ software on PC（Section 3.2）
(7) Check the establishment of the communication（Section 3.2）
(8) Load the variable information file.（Section 3.3）
(9) Ready

3.2 Startup PC software

Execute DTLScope.exe, then the main screen will appear.

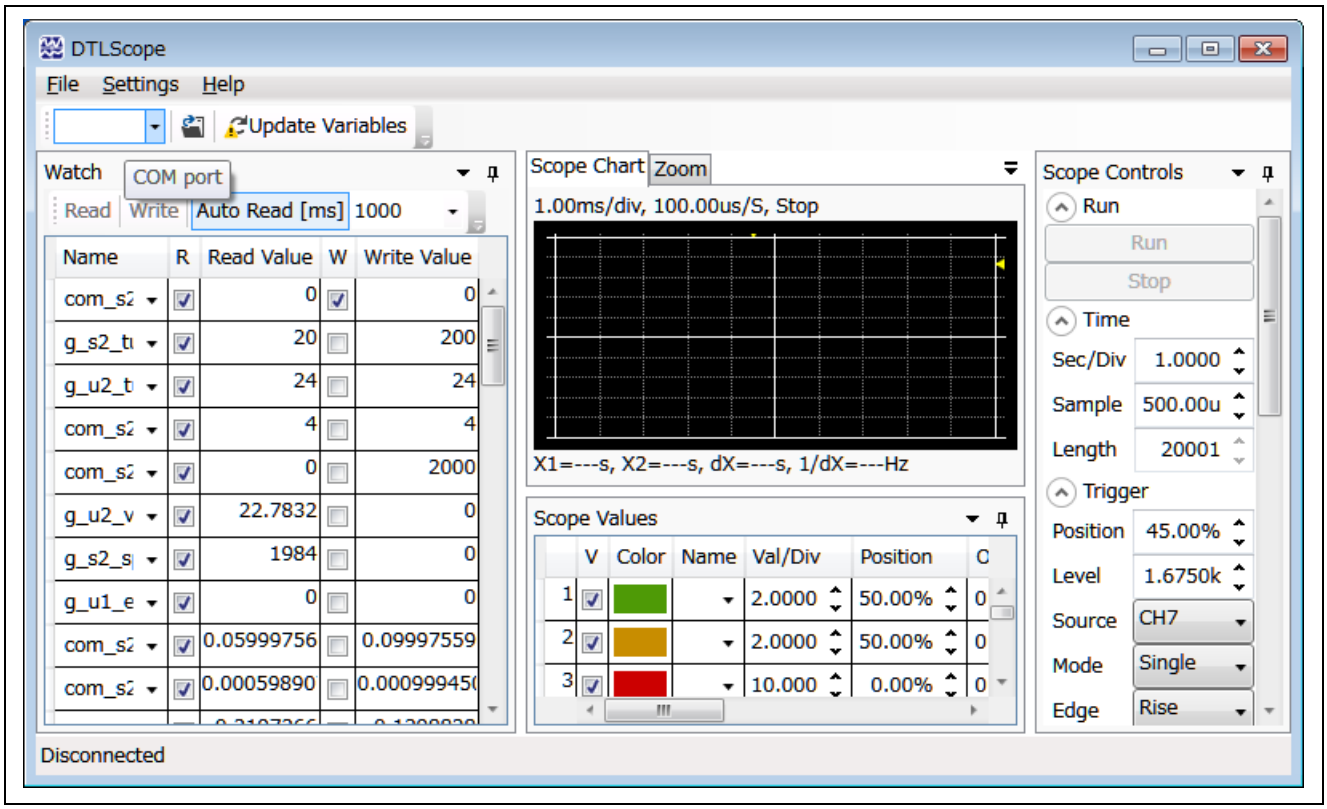


Figure 3-1 Main screen

When the communication is established, communication port is selected automatically. And the communication status is displayed at the status bar.

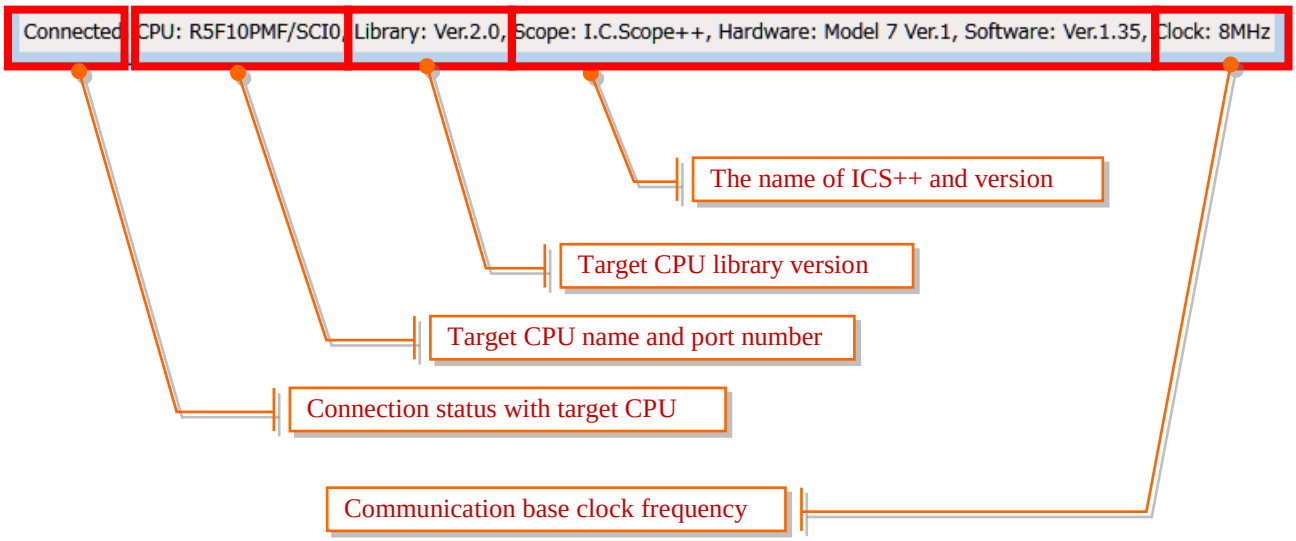


Figure 3-2 Status bar

When PC cannot recognize the ICS++ unit, “Disconnected” is displayed at the status bar. When displayed this message, please refer Section 3.1.

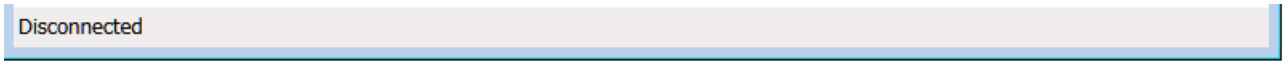


Figure 3-3 Status bar (when PC cannot recognize ICS++ unit）

When PC recognize the ICS++ unit and cannot recognize the target unit, PC software displays

“Disconnected, Scope: I.C.Scope++, Hardware: Model 7, Ver.1, Software Ver.1.35, Clock: 8Mhz”

PC software shows only ICS++ unit name and the version, not shows CPU name and the library version.

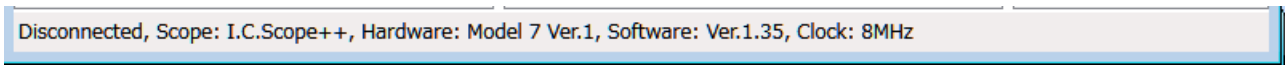


figure 3-4 Status bar (when PC recognize only ICS++ unit)

when PC recognize the ICS++ unit and the target CPU, PC software displays

“Connected, CPU:R5F10PMF/SCI0, Library: Ver2.0, Scope: I.C.Scope++, Hardware: Model 7, Ver.1, Software Ver.1.35, Clock: 8Mhz”

PC software shows both ICS++ unit information and the target CPU information.

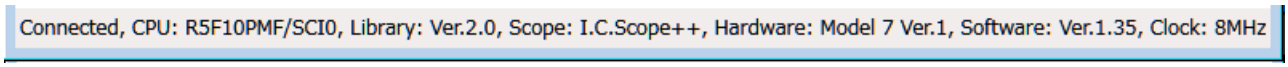


Figure 3-5 Status bar (when PC recognize both ICS unit and the target CPU）

3.3 Load variable information file

ICS++ PC software needs to load variable information file, after PC software stats up. Click “File memu” -> “Load variables”, you can load variable information file.

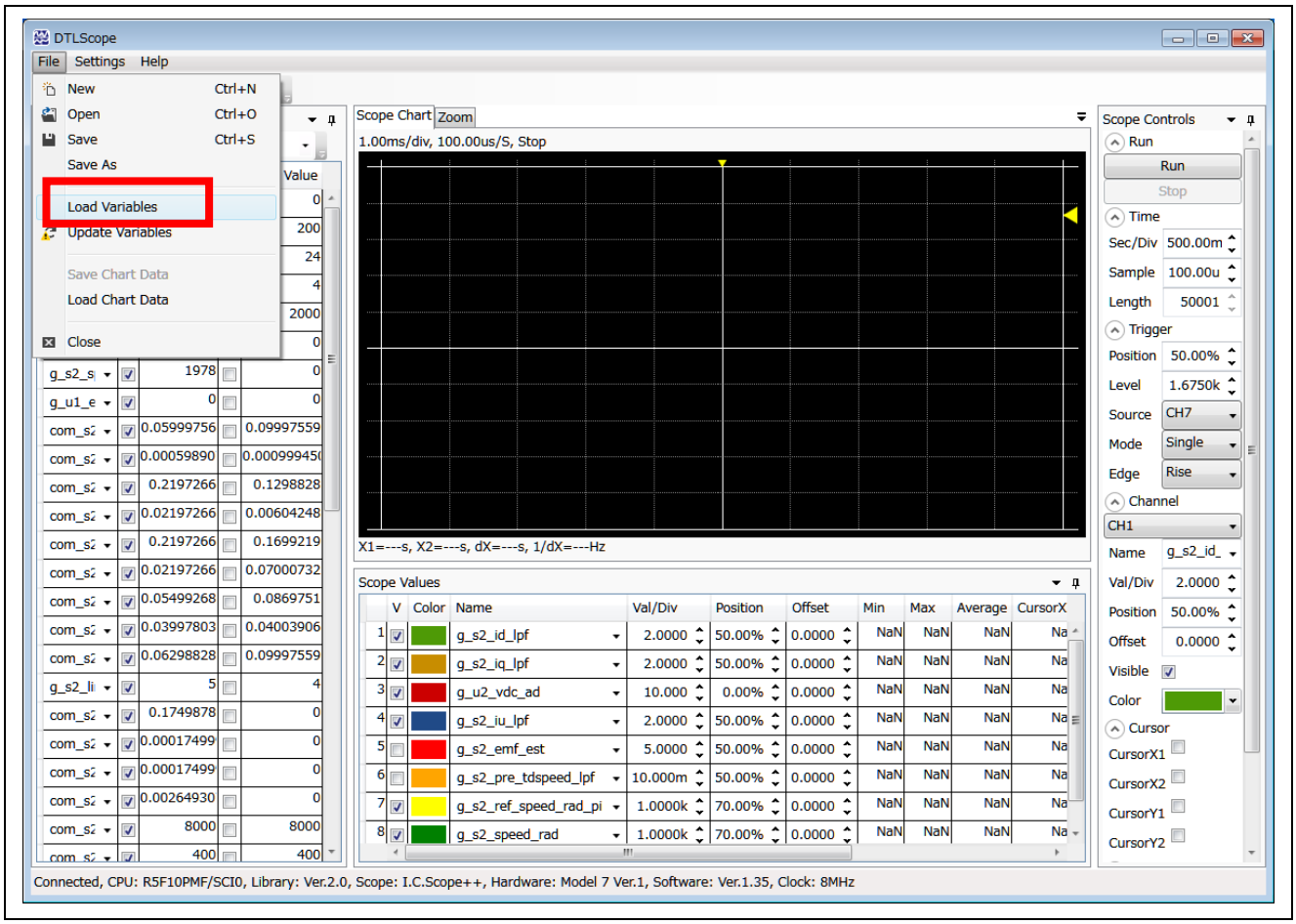


Figure 3-6 Load Variables

If you click Load variables, you can see below screen, please choose appropriate variable information file.

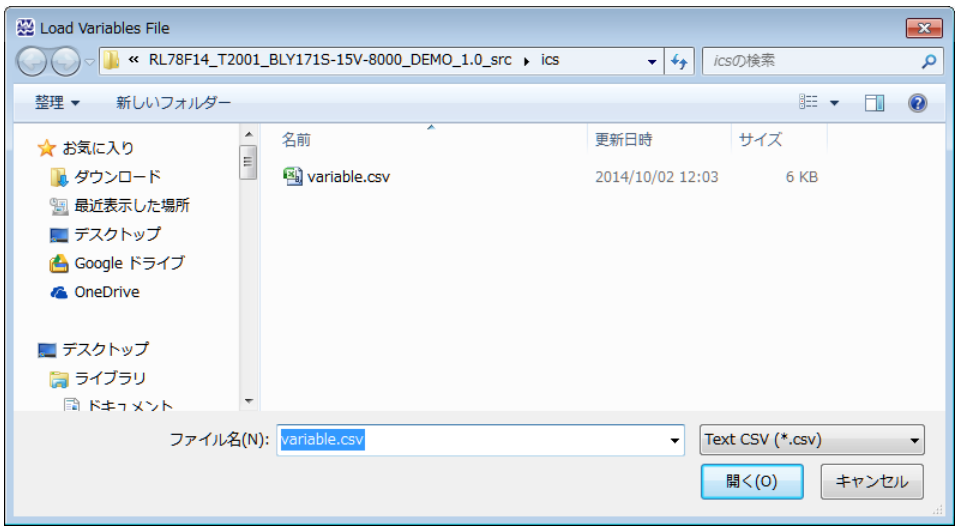


figure 3-7 Screen of choosing variable information file

If you can see ”Variable information has been loaded”, loading file is OK.

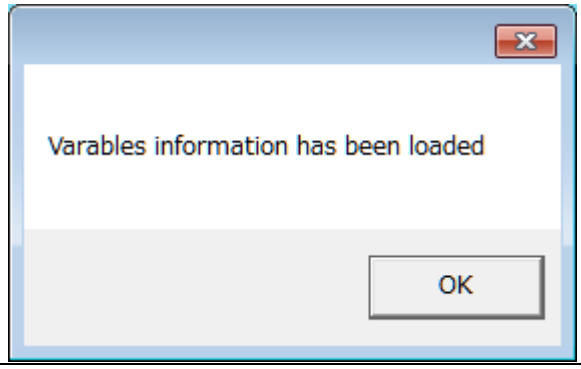


Figure 3-8 Success to load variable information file

3.4 Description of the screen

ICS++ PC software screen consists of the five screens. This chapter describes the functional overview in each screen.

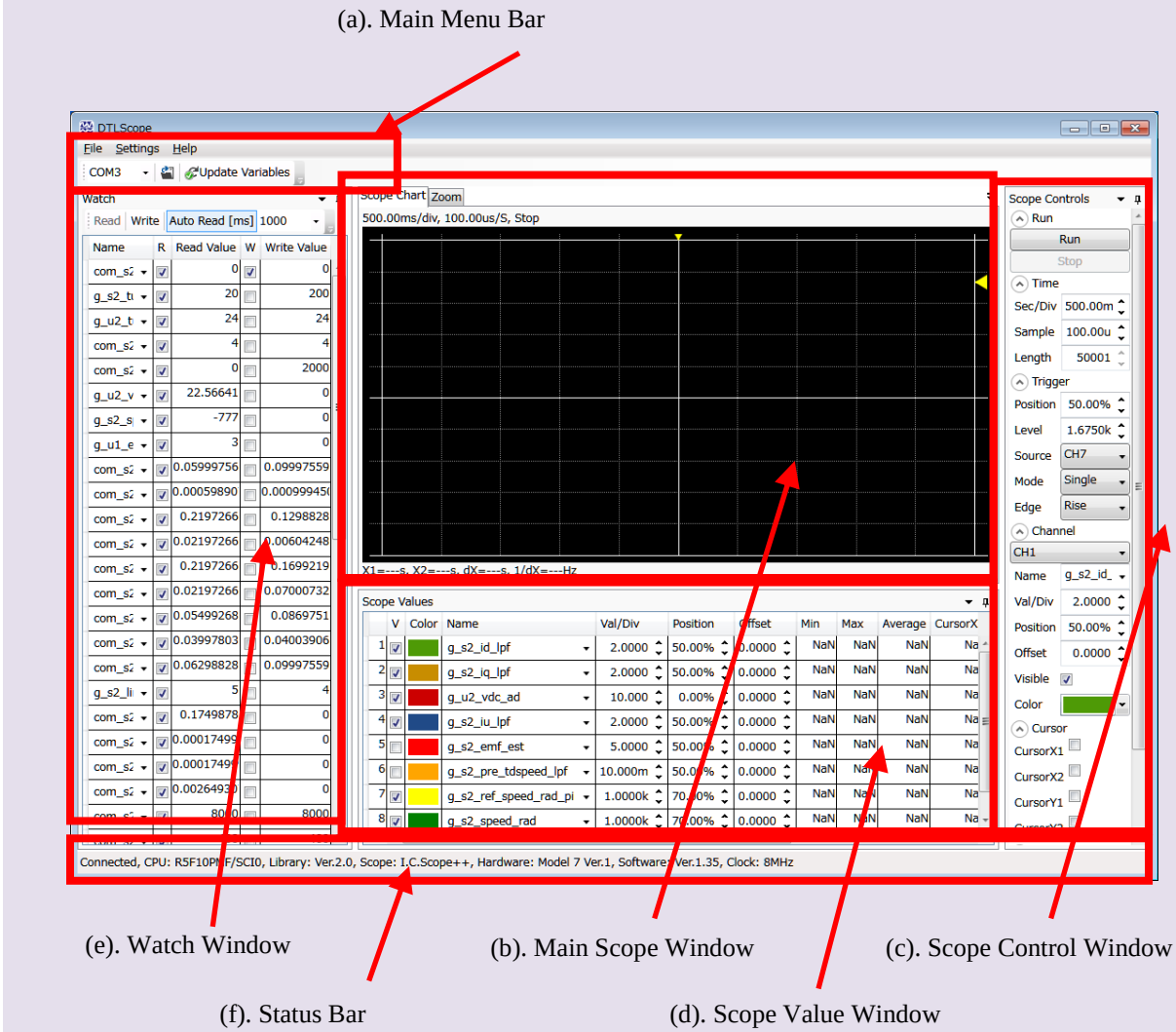


Figure 3-9 Default screen

Table 3-1 Outline of each screen

Name of screen	Functional overview
(a) Main Menu Bar	Data save, Data load, Screen setting
(b) Main Scope Window	Waveform display screen
(c) Scope Control Window	Setting range, trigger and so on (For scope function)
(d) Scope Value Window	Setting range and display the numeric data of the waveform
(e) Watch Window	Read and write a variable data
(f) Status Bar	Display a condition of ICS++ unit and target CPU

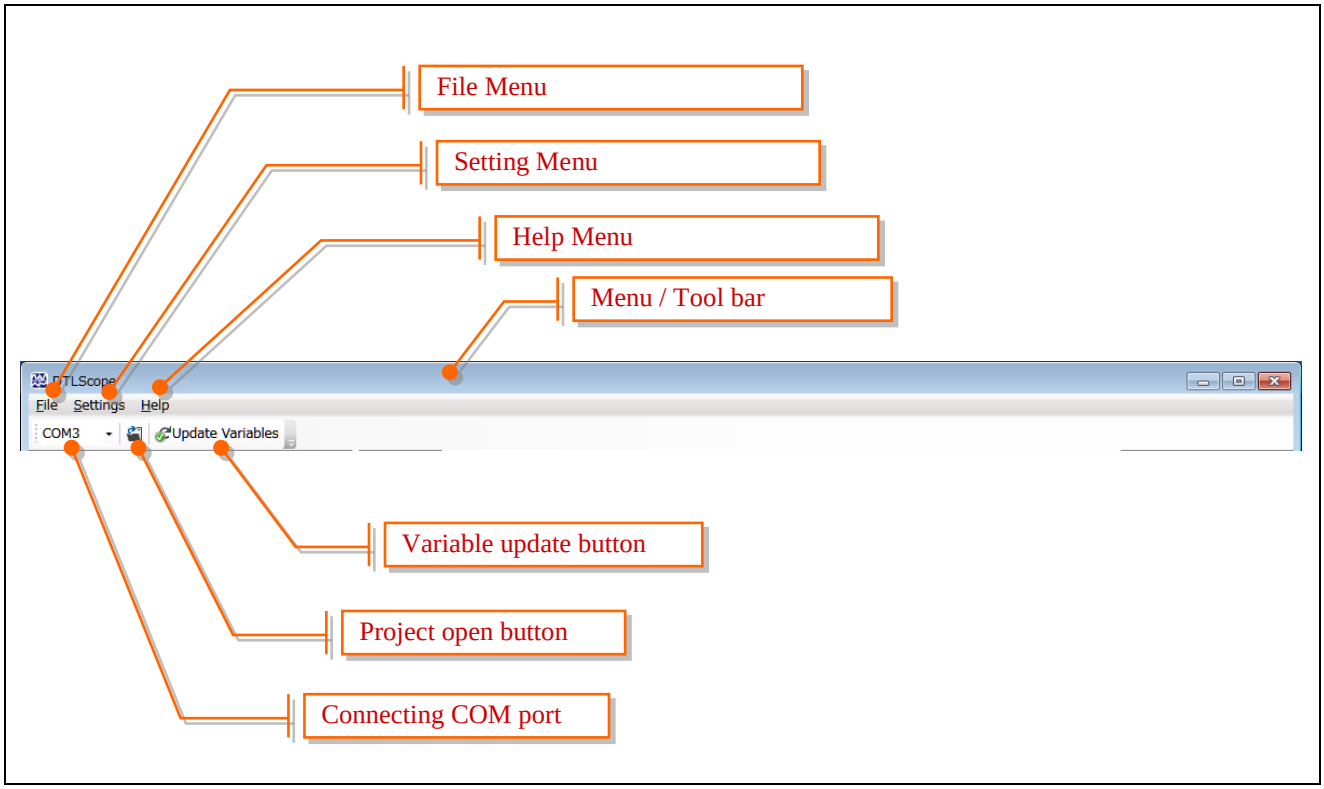


Figure 3-10 Main Menu Bar

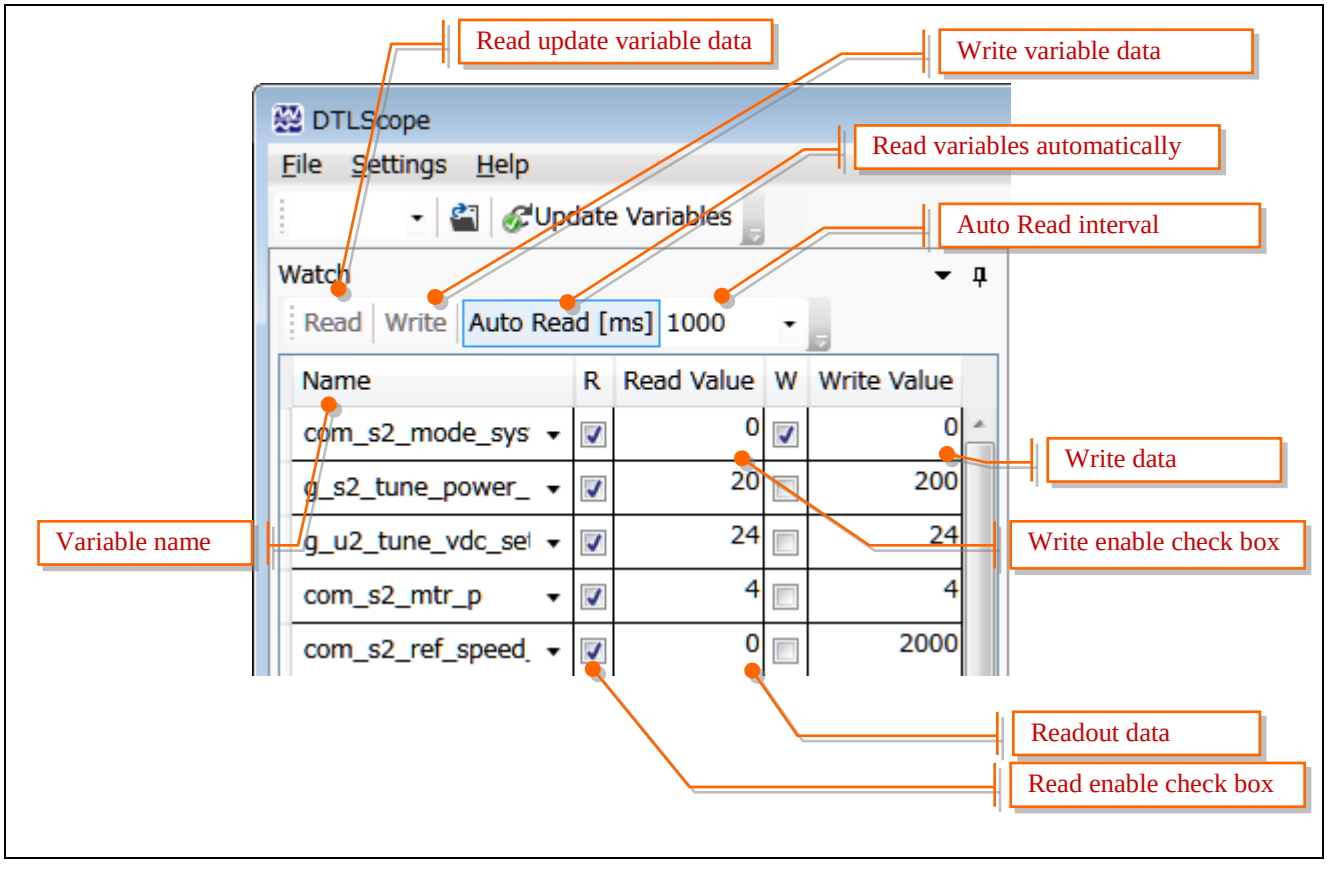


Figure 3-11 Watch window

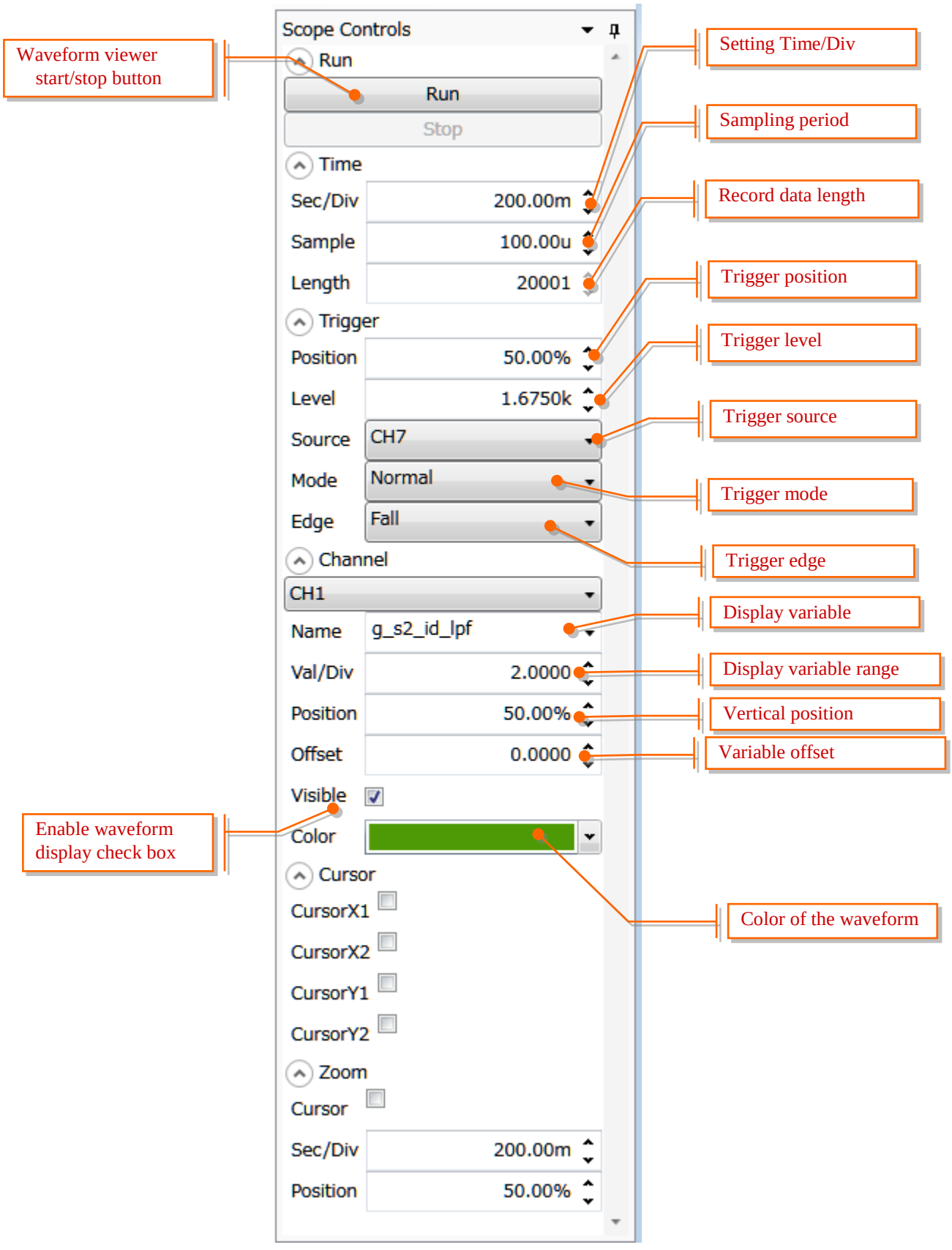
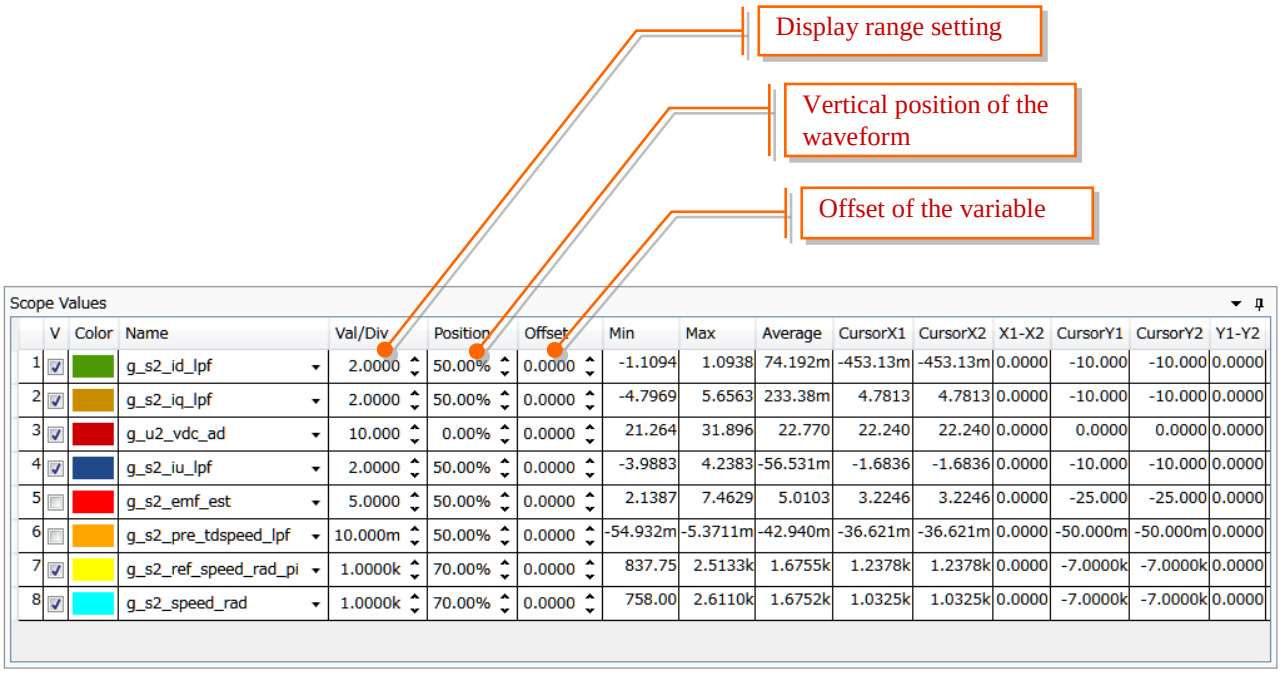


Figure 3-12 Scope controls window



	V	Color	Name	Val/Div	Position	Offset	Min	Max	Average	CursorX1	CursorX2	X1-X2	CursorY1	CursorY2	Y1-Y2
1	☑		g_s2_id_lpf	2.0000	50.00%	0.0000	-1.1094	1.0938	74.192m	-453.13m	-453.13m	0.0000	-10.000	-10.000	0.0000
2	☑		g_s2_iq_lpf	2.0000	50.00%	0.0000	-4.7969	5.6563	233.38m	4.7813	4.7813	0.0000	-10.000	-10.000	0.0000
3	☑		g_u2_vdc_ad	10.000	0.00%	0.0000	21.264	31.896	22.770	22.240	22.240	0.0000	0.0000	0.0000	0.0000
4	☑		g_s2_iu_lpf	2.0000	50.00%	0.0000	-3.9883	4.2383	-56.531m	-1.6836	-1.6836	0.0000	-10.000	-10.000	0.0000
5	☐		g_s2_emf_est	5.0000	50.00%	0.0000	2.1387	7.4629	5.0103	3.2246	3.2246	0.0000	-25.000	-25.000	0.0000
6	☐		g_s2_pre_tdspeed_lpf	10.000m	50.00%	0.0000	-54.932m	-5.3711m	-42.940m	-36.621m	-36.621m	0.0000	-50.000m	-50.000m	0.0000
7	☑		g_s2_ref_speed_rad_pi	1.0000k	70.00%	0.0000	837.75	2.5133k	1.6755k	1.2378k	1.2378k	0.0000	-7.0000k	-7.0000k	0.0000
8	☑		g_s2_speed_rad	1.0000k	70.00%	0.0000	758.00	2.6110k	1.6752k	1.0325k	1.0325k	0.0000	-7.0000k	-7.0000k	0.0000

Figure 3-13 Scope Value Window

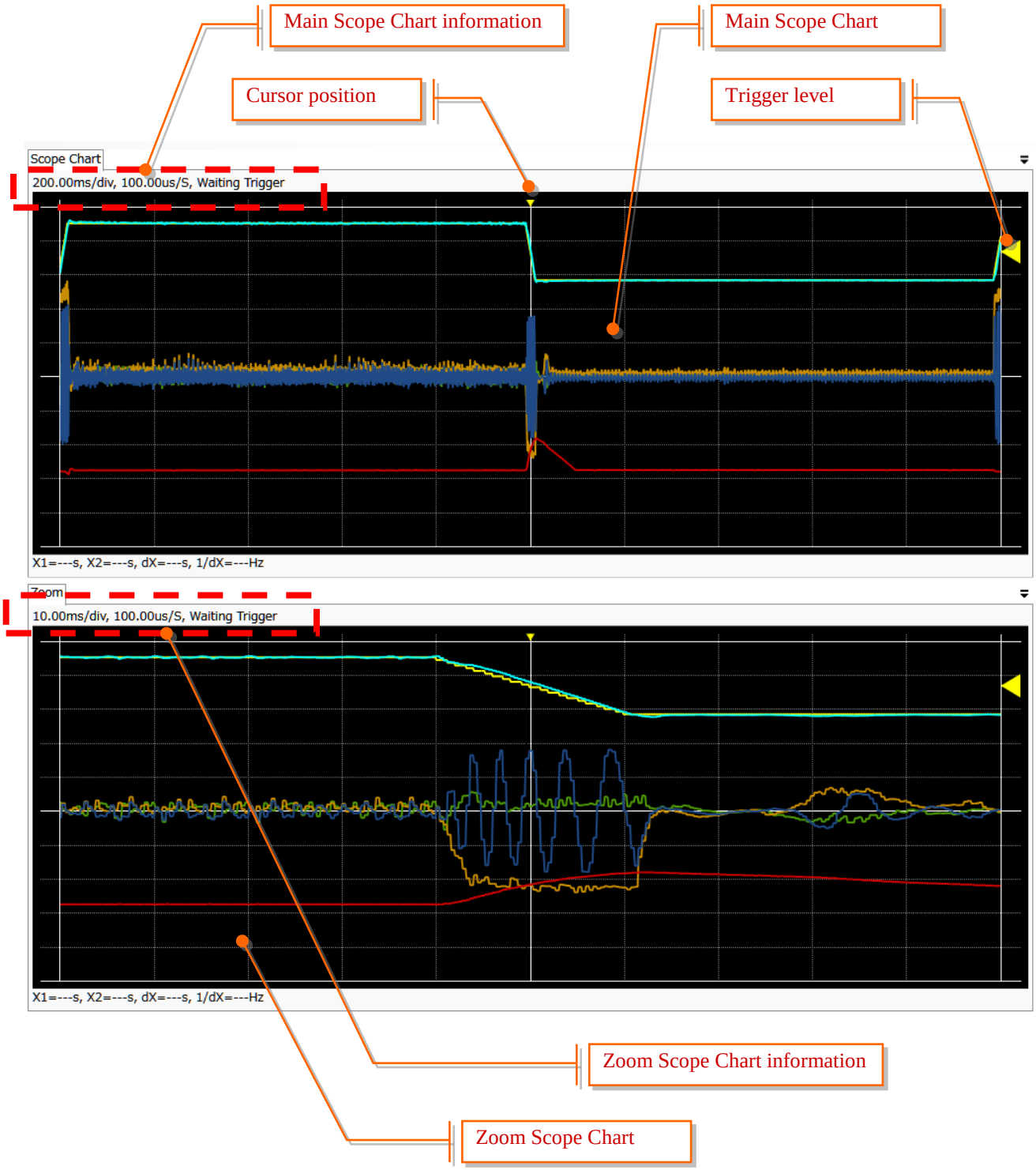


Figure 3-14 Main Scope Window

3.5 Menu Window

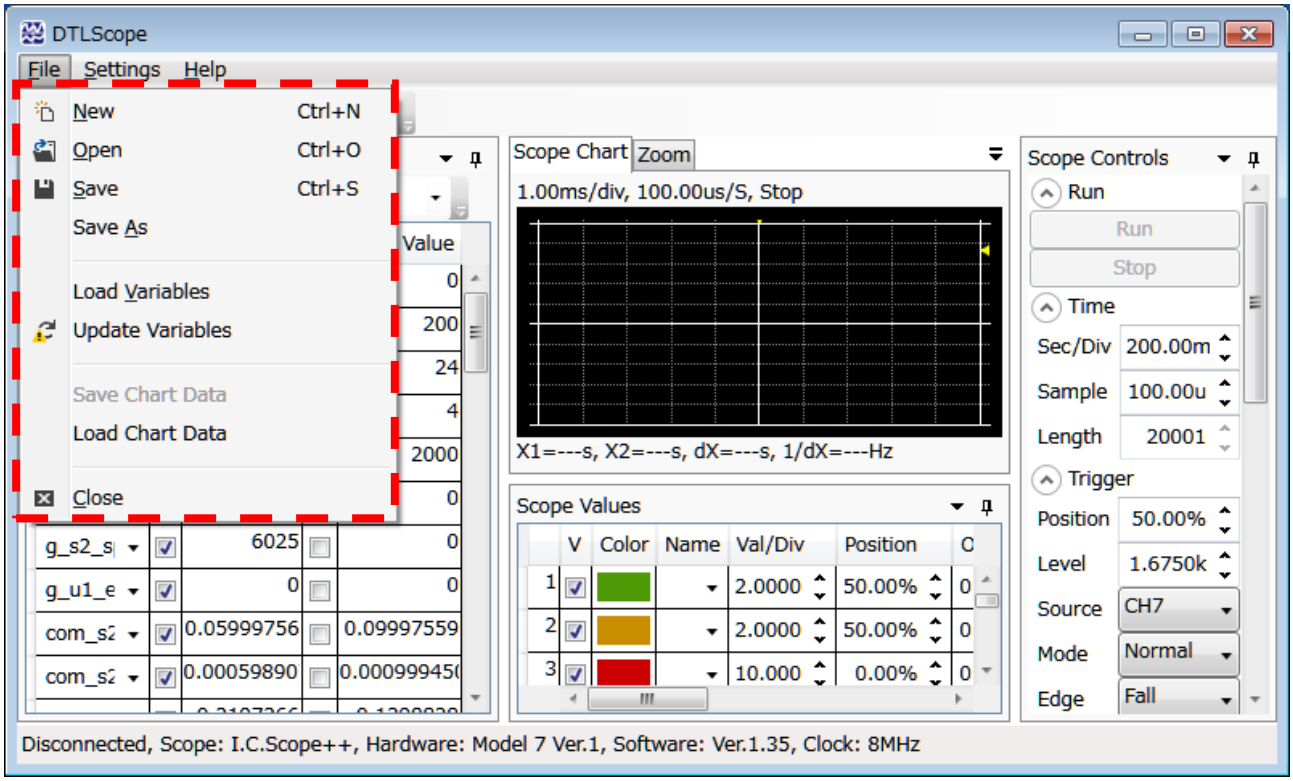


Figure 3-15 Menu bar

3.5.1 File menu

(1) New (Ctrl+N)

Clear all information of the ICS++ and load variable information file.

(2) Open (Ctrl + O)

Open the project setting file of the ICS++

(3) Save (Ctrl + S)

Save the project setting file of the ICS++

(4) Save As

Save the project setting file of the ICS++ with specifying file name.

(5) Load Variables

Load variable information file

(6) Update Variables

Reload variable information file

(7) Save Chart Data

Save Chart data

(8) Load Chart Data

Load Chart data

(9) Close

Exit ICS++

3.5.2 Setting menu

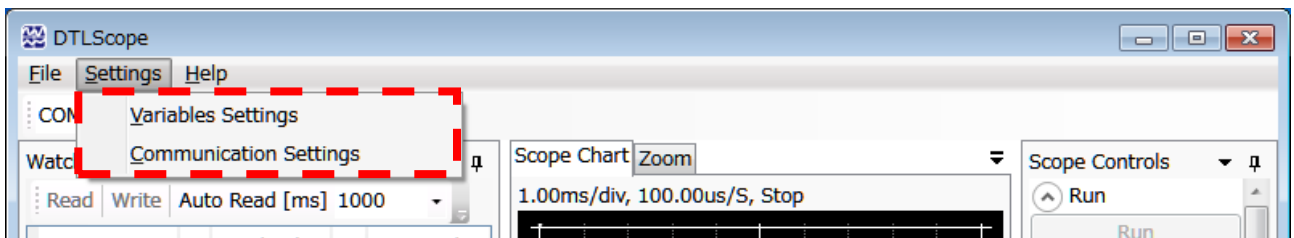


Figure 3-16　Menu ⇒ Setting

(1) Variables Settings

Modify variable information.

Variable Settings menu has these functions

A) Modify variable type

B) When the variable type is integer, this function enables scaling to variable.

C) Enable and disable read and write function

D) Alias variable name.

E) Put a comment on a variable.

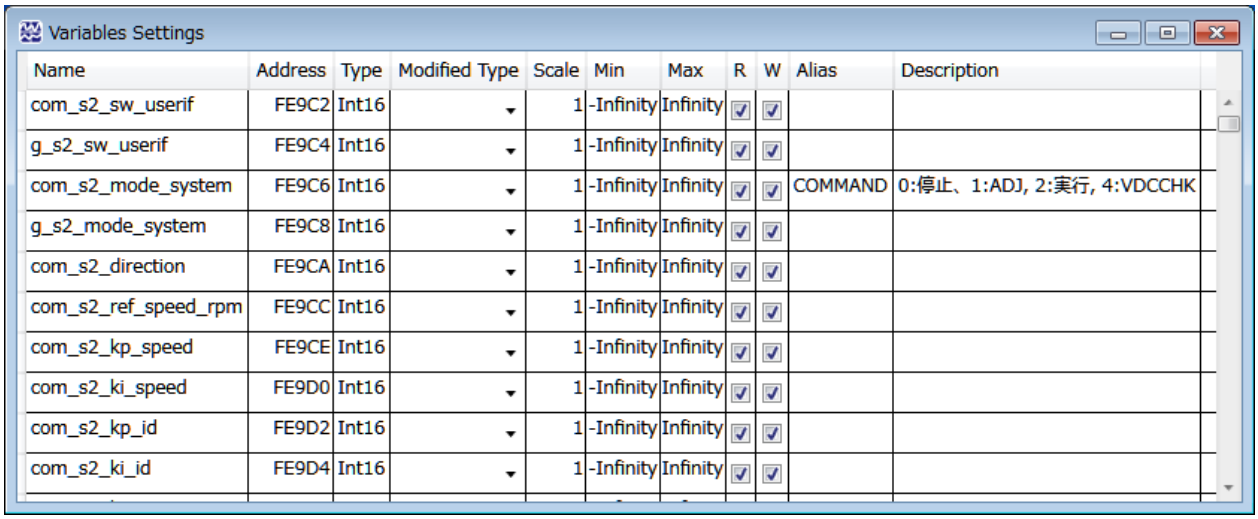


Figure 3-17　Variable Settings

(2) Communication Settings

Set a new communication rate. It can change a communication clock frequency. Please set the clock, which is specified in the function of each ICS library manual.

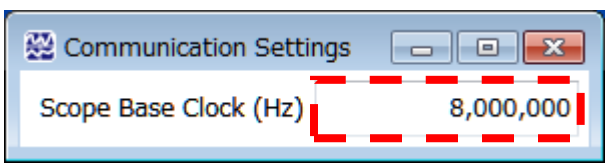


Figure 3-18　Communication Settings

※ICS (RENESAS version) can change communication clock frequency by changing the crystal oscillator. But ICS++ has a function to change variable clock function. By changing this clock setting ICS++ can change from 5,000,000Hz to 10,000,000Hz, and 12,000,000Hz, 24,000,000Hz.

3.5.3 Help Menu

(1) About DTLScope

Display the Product name, Software version and Copyright

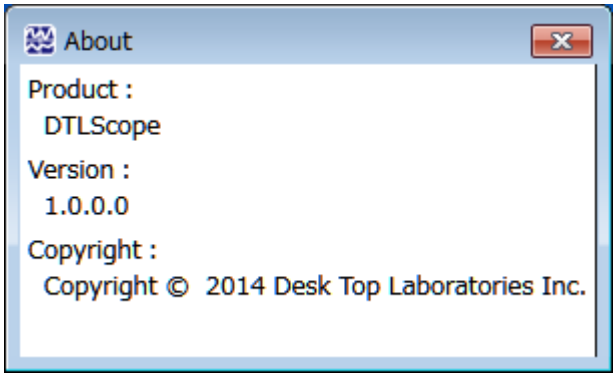


Figure 3-19 About DTL Scope

3.5.4 Choose COM port

Choose a COM port to connect ICS++ unit.

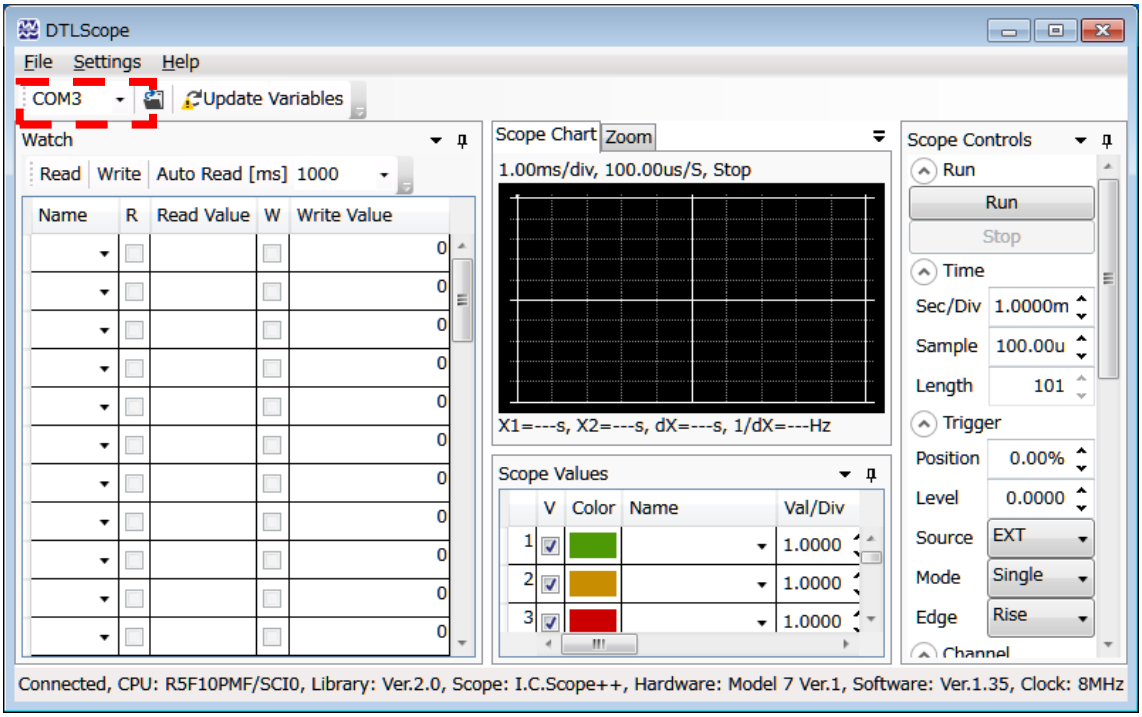


Figure 3-20 Choose COM port

3.5.5 Open project setting

Open project to be set.

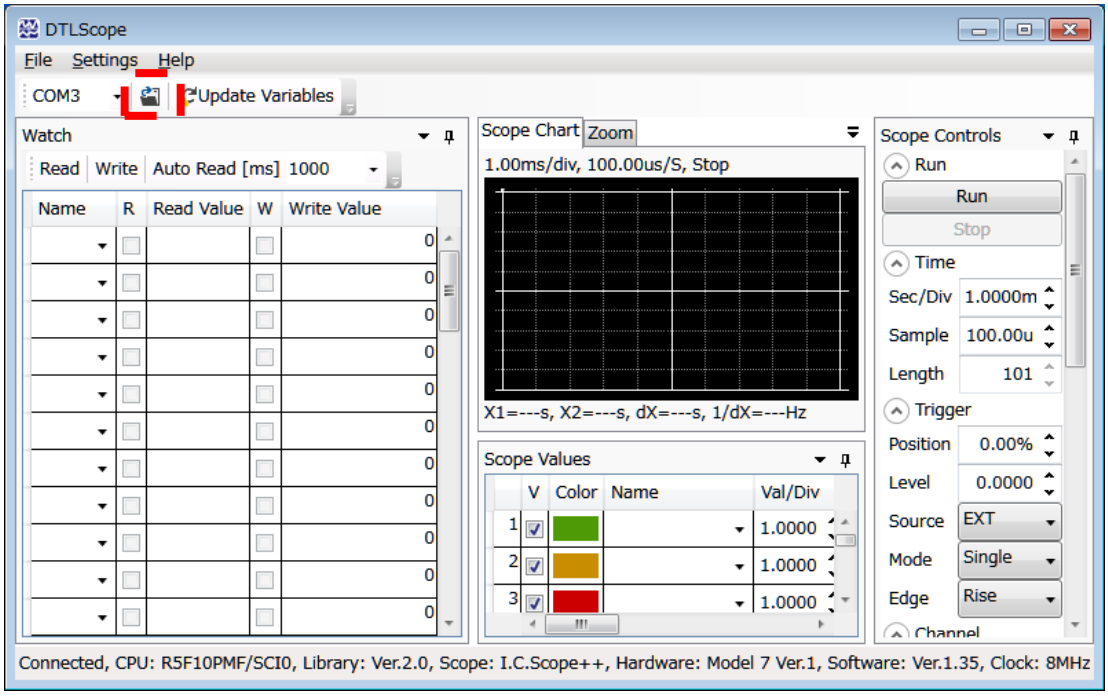


Figure 3-21 Open project setting

3.5.6 Update variable information

Update variable information

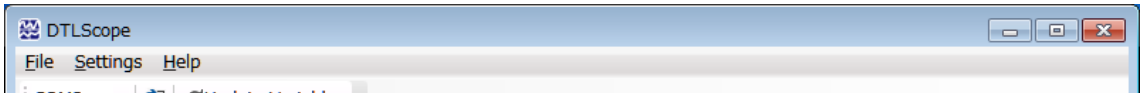


Figure 3-22 Update variable information

3.6 Oscilloscope function

In this chapter we show the necessary setting in order to use the oscilloscope function. Variable type of displaying variable waveform can be variable by the target CPU ICS library.

3.6.1 Setting of variable waveform

From pull down button of the variable name in the “Scope Controls Window” or “Scope Values Window, you can select variable name to be shown. And you can also set the variable by typing name directly.

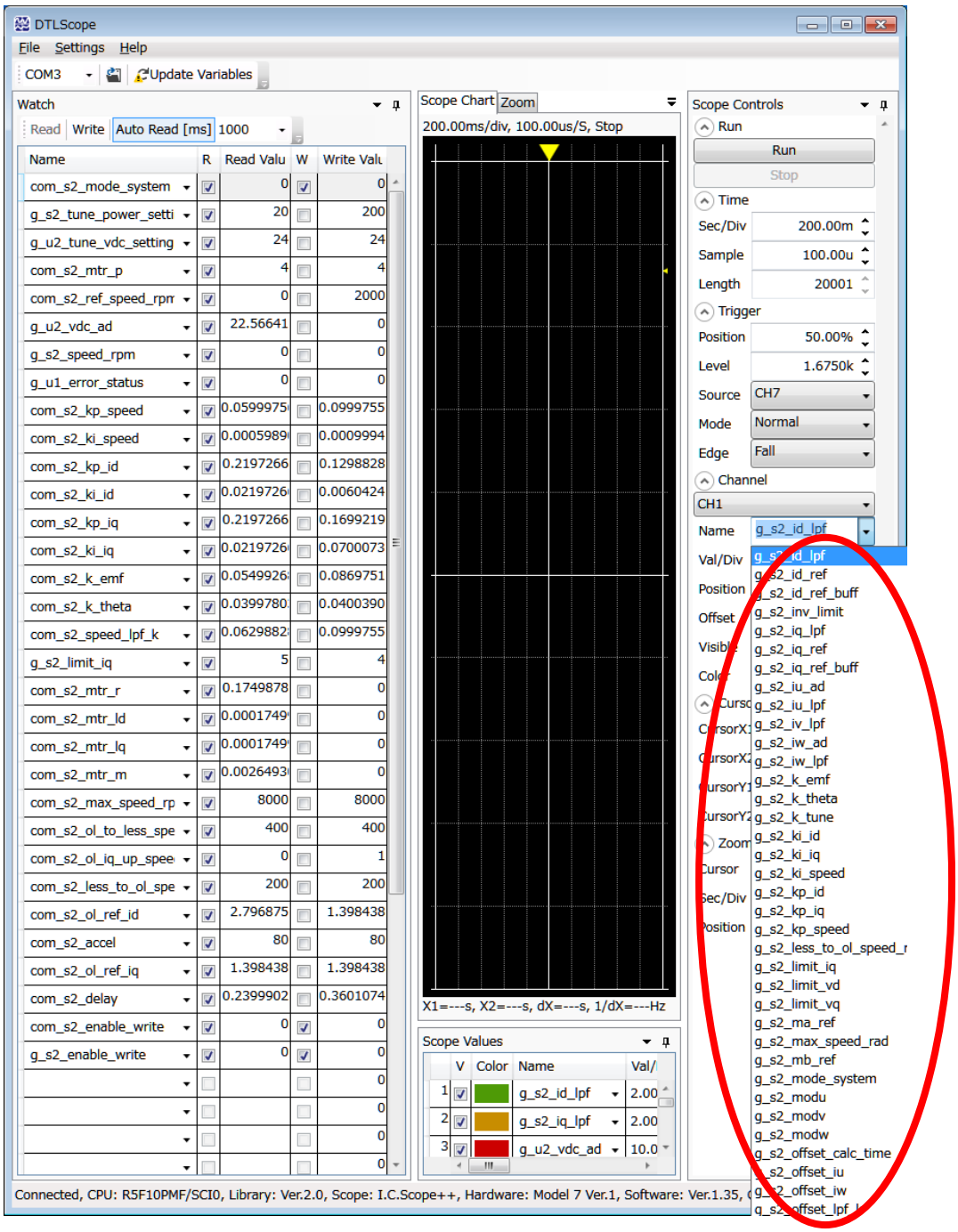


Figure 3-23 Variable name selection window in “Scope Control Window”

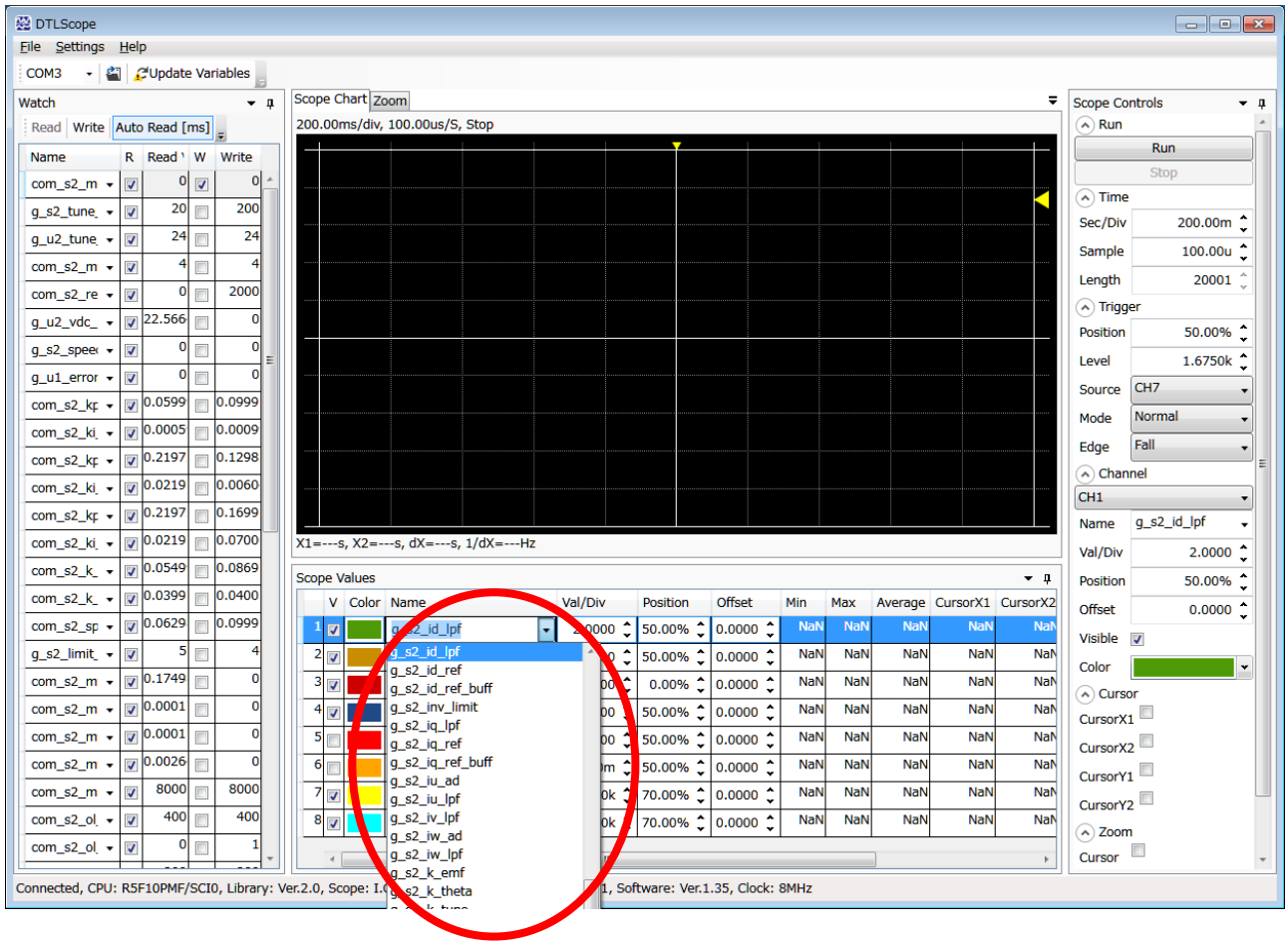


Figure 3-24 Variable selection windows in “Scope Value Window”

There are two ways to select variable. It is easier to select variables from “Scope Value Window”

3.6.2 Horizontal axis range and the sampling period

(1) Horizontal axis range

Time/Div of horizontal axis range of Main Scope Window or Zoom Window can be set by “Scope Controls Window”. Time/Div represents the time per the horizontal axis 1 scale. It can set from 100 us/Div to 262.14s/Div.

(2) Sampling period

Sampling period of a variable data can be set by “Sample” of the “Acquisition” column. It can be set from 20us to 10ms. This sampling rate is different from the measurement period. The measurement period means transferring period from the target CPU to the ICS++ unit. Sampling period means the period for sampling the variable data stored in the buffer of the ICS++ board.

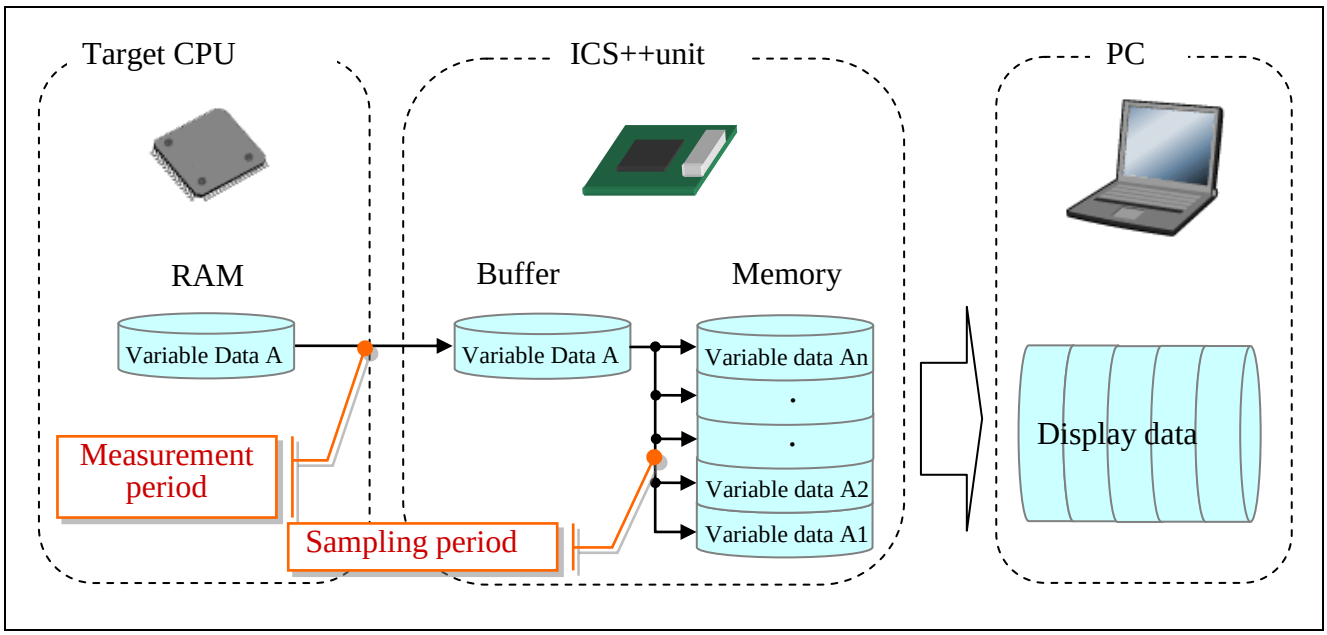


Figure 3-25 Difference between sampling period and measurement period

(3) Record length

Record length of the measured data is shown in the “Length” of the “Scope Controls Window”. This length depends 横 on the Horizontal axis range and the sampling period. （Length ＝ Time/Div ÷ Sample）

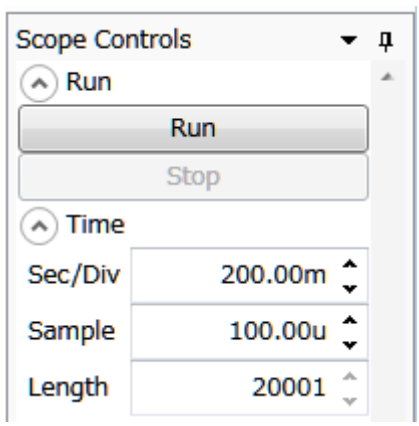


Figure 3-26 Time/Div and Sampling setting

3.6.3 Vertical axis range and the offset settings

Vertical range and the offset need to be set in each channel.

(1) Vertical range

Time/Div of vertical axis range of Main Scope Window or Zoom Window can be set by “Scope Controls Window”. Time/Div represents the value per the vertical axis 1 scale. It can set from 1p/Div to 1T/Div.

(2) Offset

Offset can be set by “Offset” column of the “Scope Value”. It displays the waveform to each variable by adding the value set by the “offset”.

(3) Position

This setting specifies the display position on the whole screen.

Scope Values

	V	Color	Name	Val/Div	Position	Offset	Min	Max	Average	CursorX1	CursorX2	X1-X2	CursorY1	CursorY2	Y1-Y2
1	☑		g_s2_id_lpf	2.0000	50.00%	0.0000	-1.1094	1.0938	74.192m	-453.13m	-453.13m	0.0000	-10.000	-10.000	0.0000
2	☑		g_s2_iq_lpf	2.0000	50.00%	0.0000	-4.7969	5.6563	233.38m	4.7813	4.7813	0.0000	-10.000	-10.000	0.0000
3	☑		g_u2_vdc_ad	10.000	0.00%	0.0000	21.264	31.896	22.770	22.240	22.240	0.0000	0.0000	0.0000	0.0000
4	☑		g_s2_iu_lpf	2.0000	50.00%	0.0000	-3.9883	4.2383	-56.531m	-1.6836	-1.6836	0.0000	-10.000	-10.000	0.0000
5	☐		g_s2_emf_est	5.0000	50.00%	0.0000	2.1387	7.4629	5.0103	3.2246	3.2246	0.0000	-25.000	-25.000	0.0000
6	☐		g_s2_pre_tdspeed_lpf	10.000m	50.00%	0.0000	-54.932m	-5.3711m	-42.940m	-36.621m	-36.621m	0.0000	-50.000m	-50.000m	0.0000
7	☑		g_s2_ref_speed_rad_pi	1.0000k	70.00%	0.0000	837.75	2.5133k	1.6755k	1.2378k	1.2378k	0.0000	-7.0000k	-7.0000k	0.0000
8	☑		g_s2_speed_rad	1.0000k	70.00%	0.0000	758.00	2.6110k	1.6752k	1.0325k	1.0325k	0.0000	-7.0000k	-7.0000k	0.0000

Figure 3-27 Setting of Val/Div, Offset, Position

3.6.4 Trigger setting

(1) Trigger channel

Choose a trigger source channel by pull-down menu of the “Trigger Source” in the “Controls Window”.

The selected trigger channel is shown at the top of the “Main Scope Window”.

(2) Trigger mode

Select the trigger mode from the three mode.

The selected trigger mode is shown at the top of the “Main Scope Window”.

- Auto mode : Update waveform every time the trigger condition is detected or if a certain period of the time trigger signal is not detected.
- Single mode : Update waveform only once, if the trigger condition is detected.
- Normal mode : Update waveform every time the trigger condition is detected.

(3) Trigger position and the trigger level

If the trigger channel is set from CH1 to CH8, Trigger point is set to the intersection of the trigger position and the trigger level.

Trigger position is shown at the top of the “Main Scope Window”.

- Trigger position：It can be set by “Trigger position” in the ”Scope control Window”.
  （Max value：Record length * sampling period、Min value：sampling period）
- Trigger level ：It can be set by “Trigger level” in the ”Scope control Window”.
  （Max value：Val/Div * 5、 Min value：Val/Div * (-5)）

(4) Trigger edge

Trigger edge can be choose from below three type of conditions.

- Rise ：Rising edge
- Fall ：Falling edge
- Both ：Both rising and falling edge

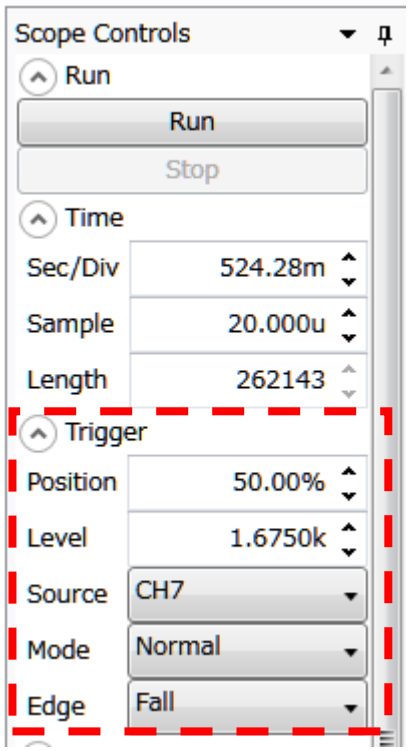


Figure 3-28 Trigger setting (1)

Figure 3-29 Trigger setting (2)

3.6.5 Cursor setting

The value of the intersection of the waveform and the four cursors “Cursor X1”, “Cursor X2”, Cursor Y1”, “Cursor Y2” are shown at the bottom of the “Scope Value Window”. ON and OFF of the cursor is set by the check box in the “Scope Controls Window”.

V	Color	Name	Val/Div	Position	Offset	Min	Max	Average	CursorX1	CursorX2	X1-X2	CursorY1	CursorY2	Y1-Y2
1		g_s2_id_lpf	2.0000	50.00%	0.0000	-750.00m	953.13m	37.020m	140.63m	593.75m	-453.13m	-4.1327	4.1156	-8.2483
2		g_s2_iq_lpf	2.0000	50.00%	0.0000	-718.75m	5.4531	1.2273	2.6250	3.9375	-1.3125	-4.1327	4.1156	-8.2483
3		g_u2_vdc_ad	10.000	0.00%	0.0000	21.156	22.893	22.392	22.459	21.156	1.3027	29.337	70.578	-41.241
4		g_s2_iu_lpf	2.0000	50.00%	0.0000	-4.1641	4.0430	-61.931m	-97.656m	2.7148	-2.8125	-4.1327	4.1156	-8.2483
5		g_s2_emf_est	5.0000	50.00%	0.0000	2.6777	7.4941	4.8028	2.8457	7.1094	-4.2637	-10.332	10.289	-20.621
6		g_s2_pre_tdspeed_lpf	10.000m	50.00%	0.0000	-53.223m	-23.682m	-37.087m	-35.889m	-26.367m	-9.5215m	-20.663m	20.578m	-41.241m
7		g_s2_ref_speed_rad_pi	1.0000k	70.00%	0.0000	837.75	2.5133k	1.6459k	917.75	2.5133k	-1.5955k	-4.0663k	57.823	-4.1241k
8		g_s2_speed_rad	1.0000k	70.00%	0.0000	830.00	2.6280k	1.6262k	893.50	2.5500k	-1.6565k	-4.0663k	57.823	-4.1241k

Figure 3-30 Cursor setting

3.6.6 ZOOM screen setting

ICS++ has one zoom function which enhances a part of the “Main Scope Window”. The display range of the Zoom screen has been shown in the frame on the “Main Scope Window”. And the check box in the “Scope Controls Window” can set ON and OFF of the display range frame.

(1) Zoom display range width

“Zoom” ⇒ the Spin control of “Sec/Div” in the “Scope Controls Window” can be set the width of the Zoom display range width.

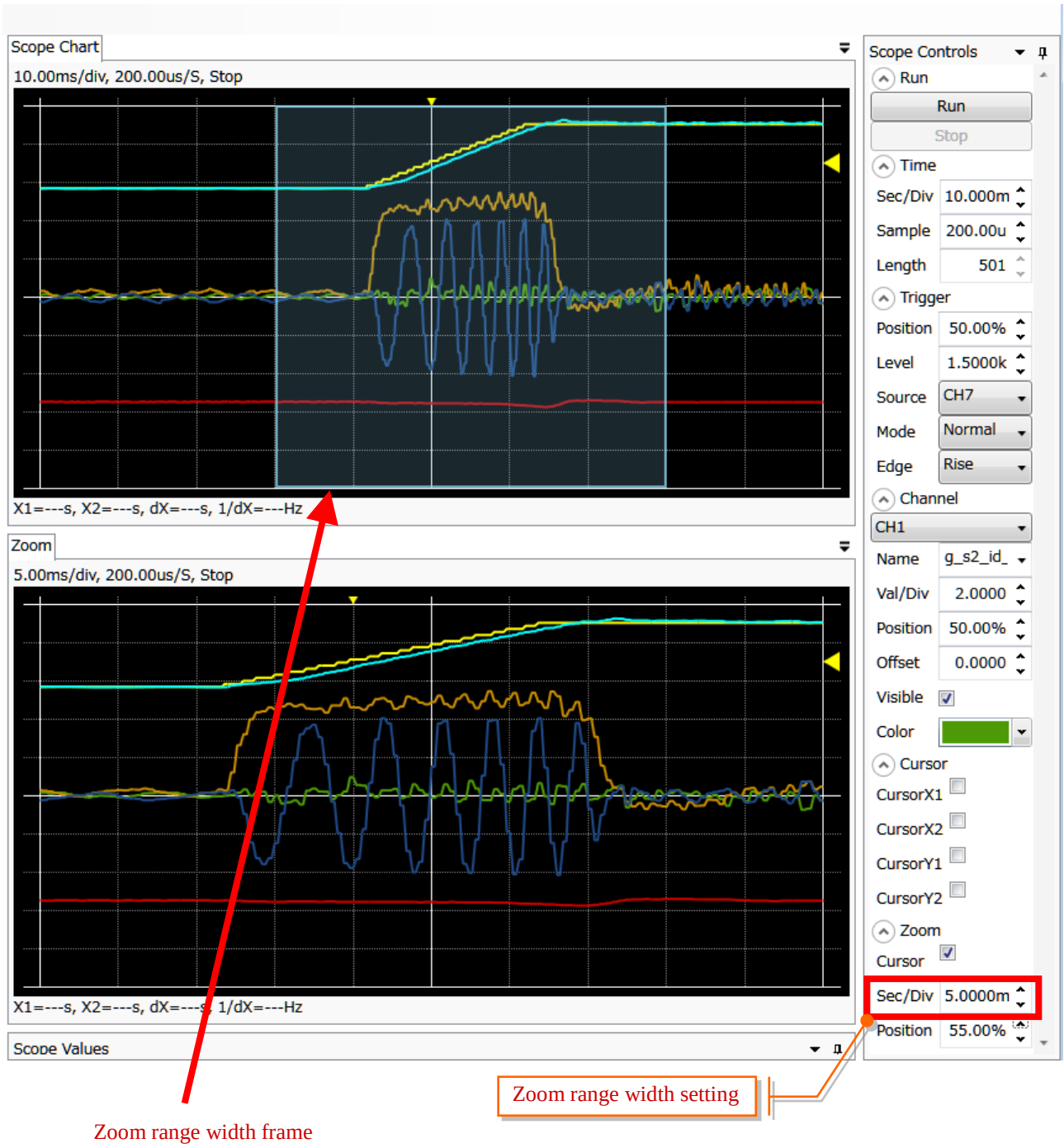


Figure 3-31 Zoom range width setting

(2) Zoomed display start position

This value can be set in the “Zoom” ⇒ “Position” in the “Scope Controls Window”

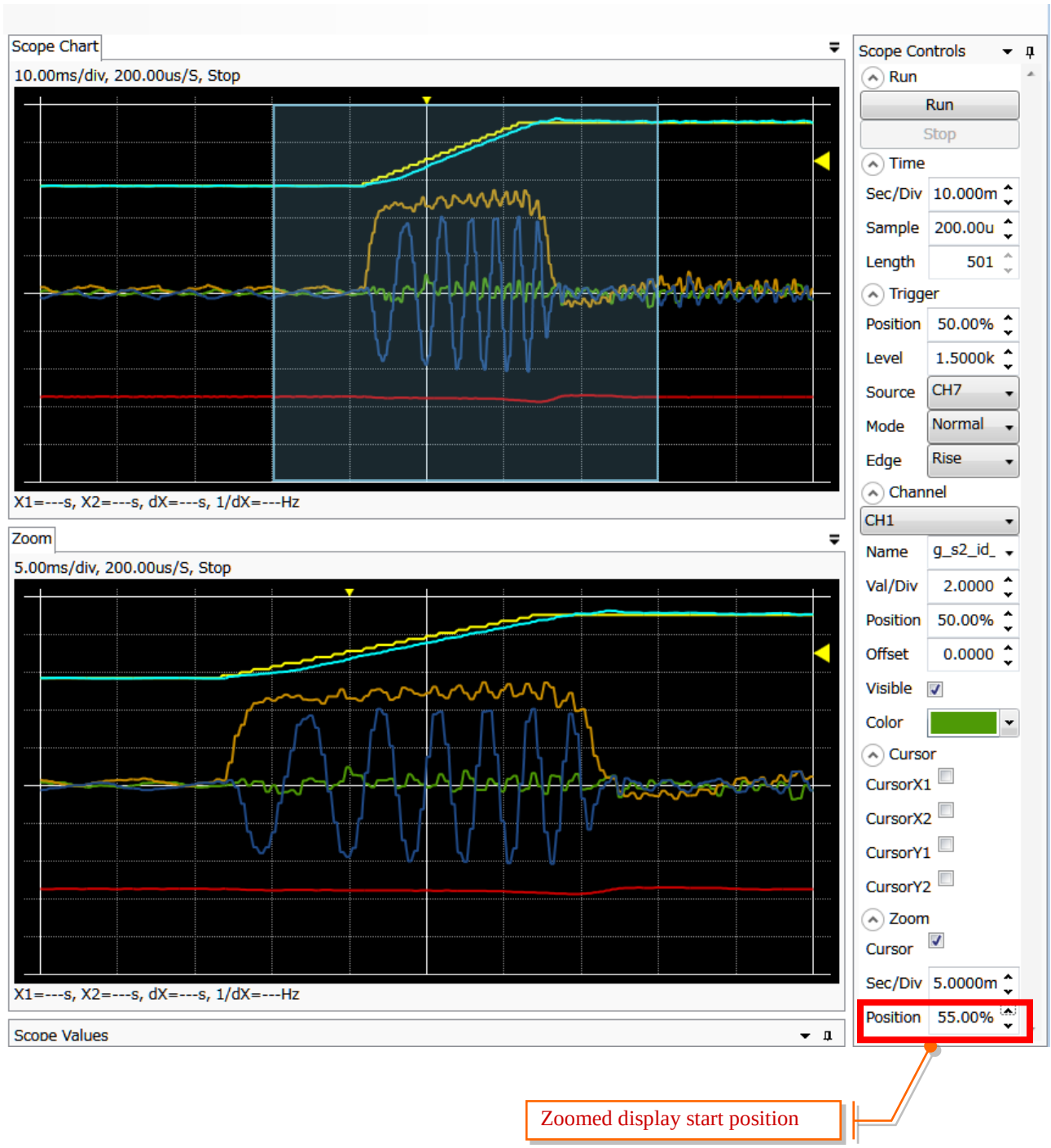


Figure 3-32 Zoomed display start position setting

3.6.7 Save and Load Waveform data

ICS++ has a function of save and load waveform data.

(1) ICS++ Chart setting file (*.dtlcd) : Setting information of the waveform

(2) ICS++ Chart Data File(*.dtlcd.csv) :Raw waveform data

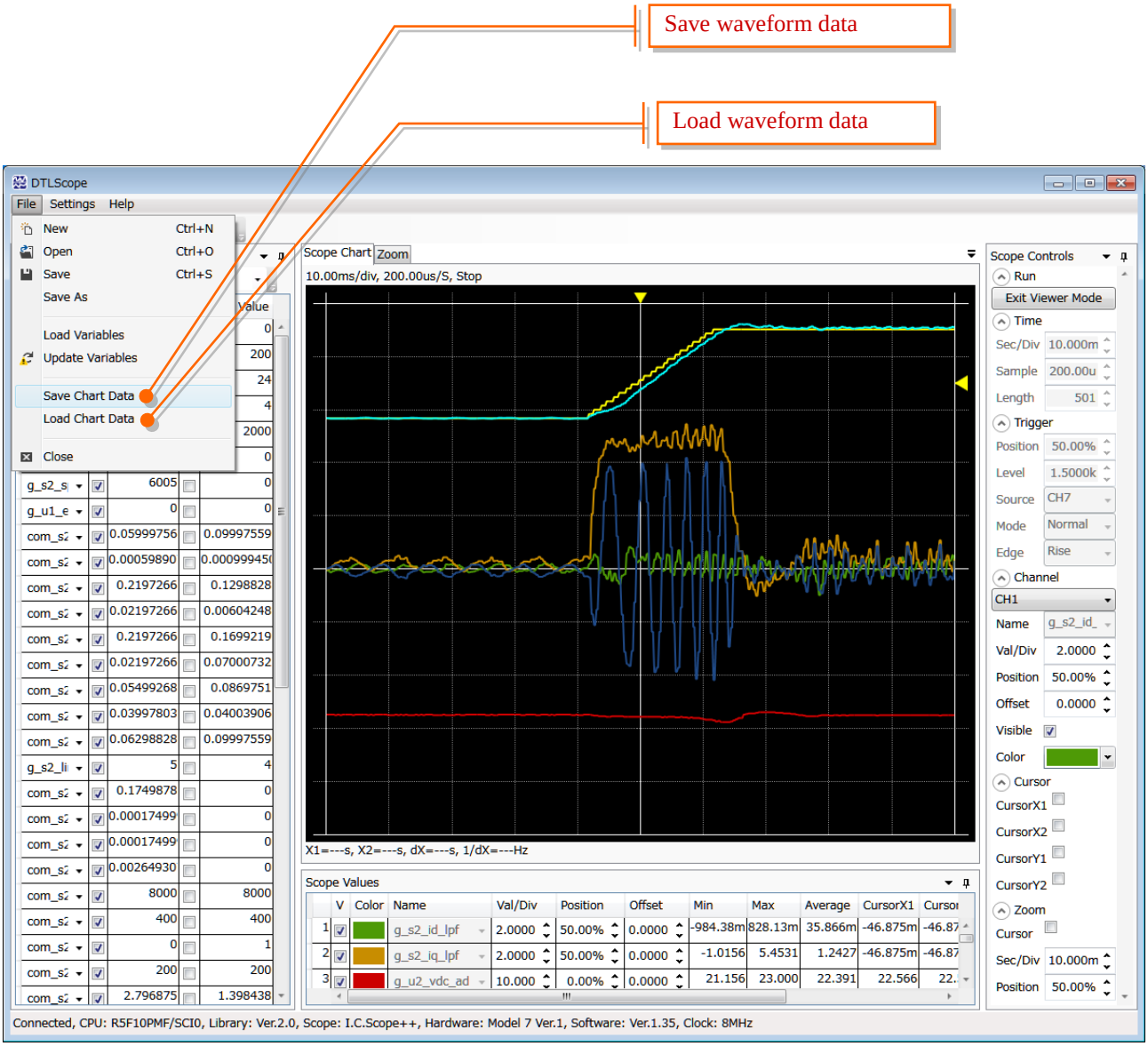


Figure 3-33 Save and Load waveform data

3.7 Function of read and write the value of the variable

This chapter shows the function of read and write variable.

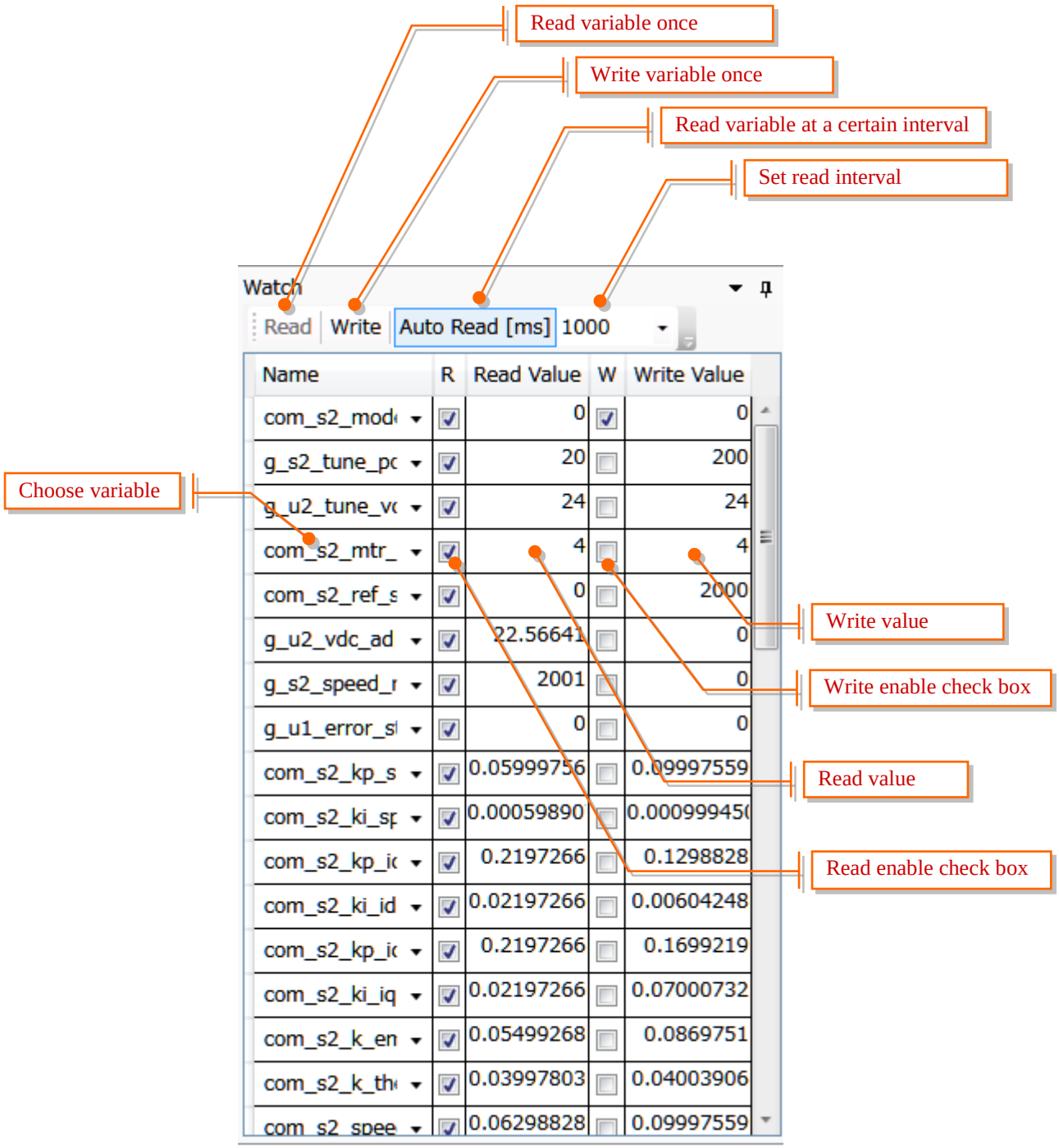


Figure 3-34 Watch Window

By manipulating the order from (1) to (5), it is possible to use the function of read/write variables.

(1) Choose variable

Choose variable name from the “Name” in the “Watch Window”.

(2) Enable read/write

Check the check box of the R and W raw, then it enables the read and write functions.

(3) Execute Read/Write/Auto Read

Click the “Read button”, then read a variable from the target CPU and display it.

Click the “Write button”, then write a variable to the target CPU.

Click the “Auto Read” button, then PC software read the variables at a certain period.

(4) Choose data type

You can modify the default variable type by changing “Modified type” in the “Variable Setting”.

(5) Scale rate setting

You can modify the scaling value by changing “Scale” in the “Variable Setting”. This setting is also active to the chart display window.

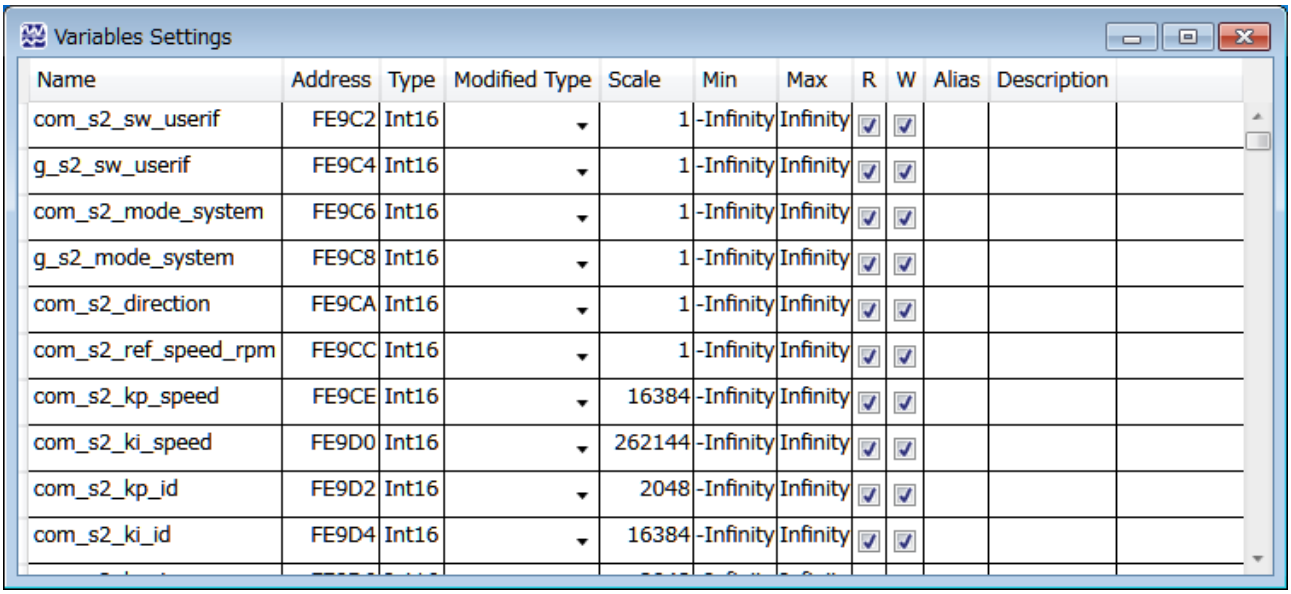


Figure 3-35 Variables Settings Window

4. Installing ICS++ PC software (DTLScope.exe)

4.1

5. ICS++ system settings

5.1 Connection of ICS++ system

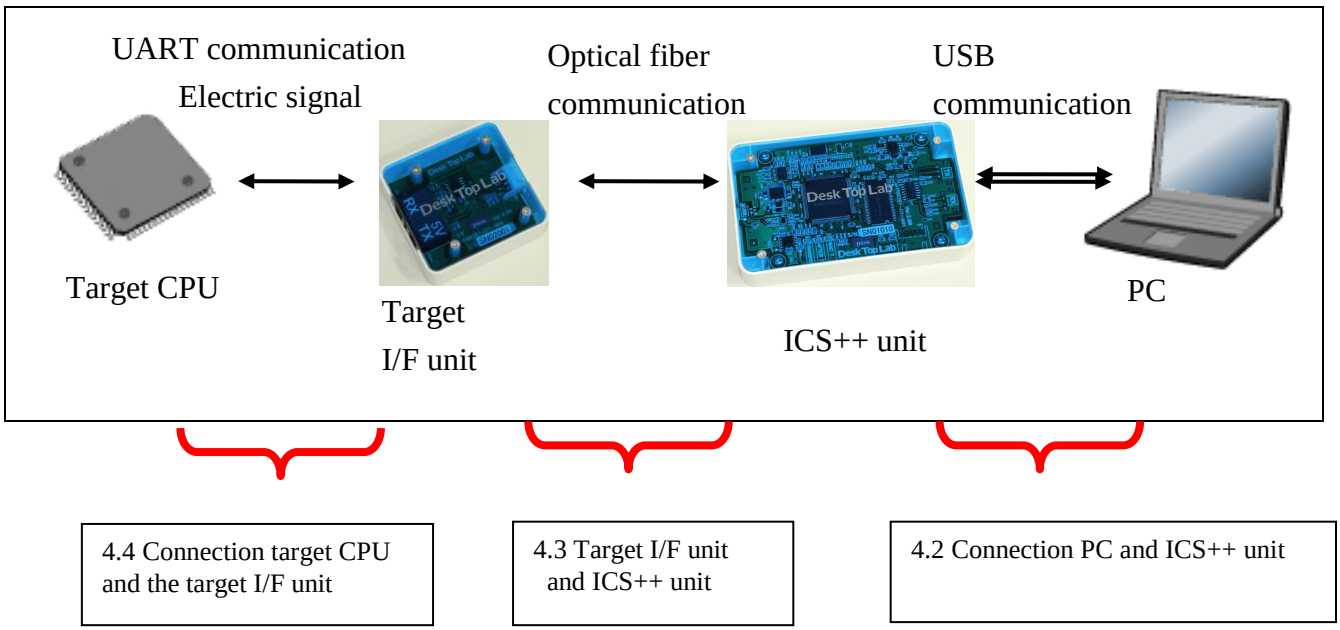


Figure 5-1 Hardware configuration

5.2 Connection between PC and ICS++ unit

Please connect between PC and the ICS++ unit by USB cable.

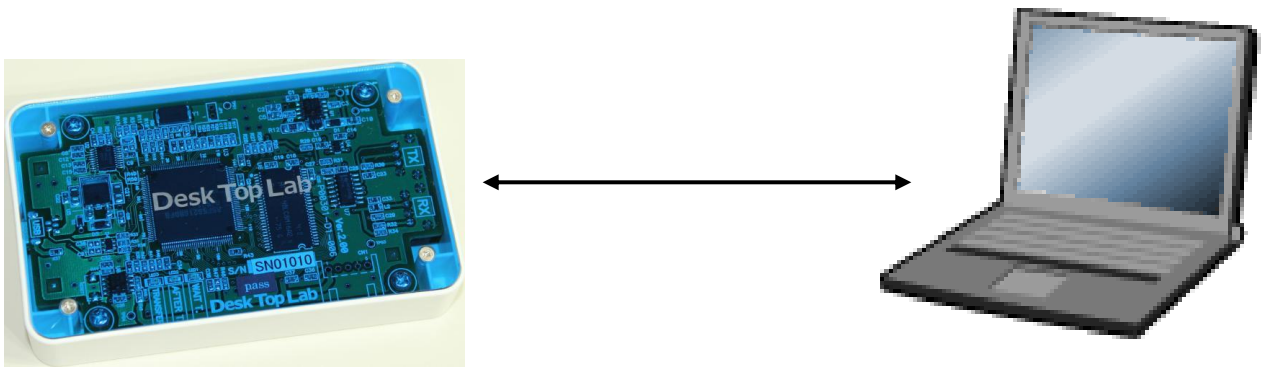


Figure 5-2 Connection PC and ICS++ unit

5.3 Connection between target I/F unit and ICS++ unit

Connect the target I/F unit and the ICS++ unit by optical fiber.

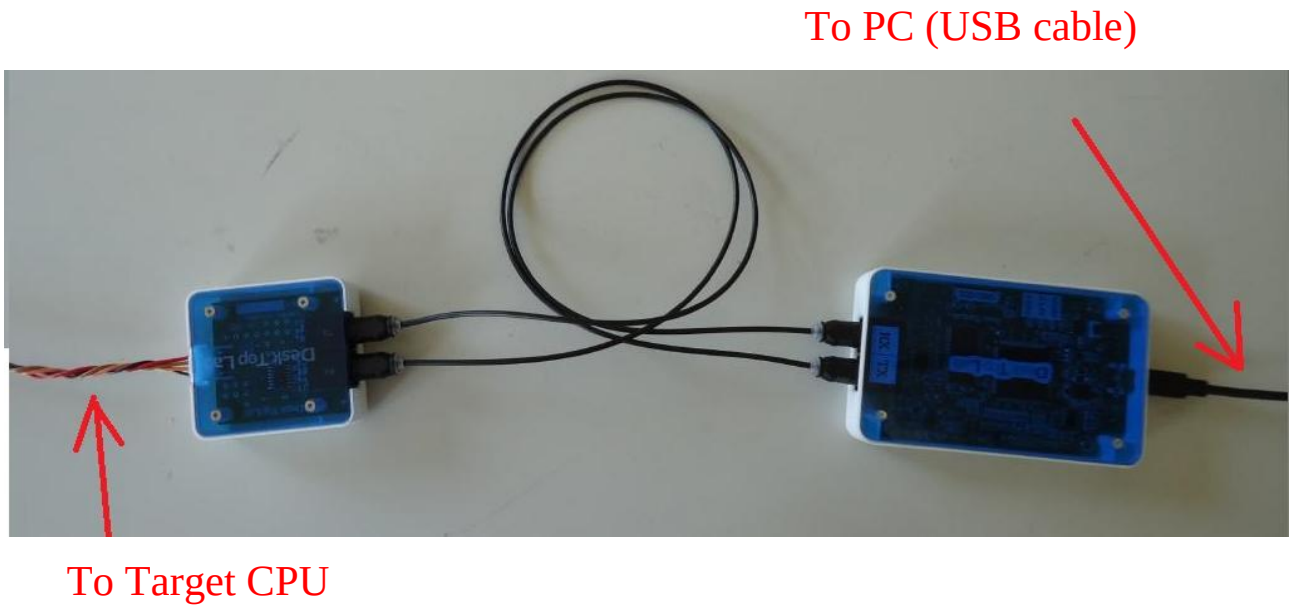


Figure 5-3 Connection between the target I/F unit and the ICS++ unit

Connect the optical fiber following

TX of the Target I/F unit	＜－＞	RX of the ICS++ unit
RX of the Target I/F unit	＜－＞	TX of the ICS++ unit

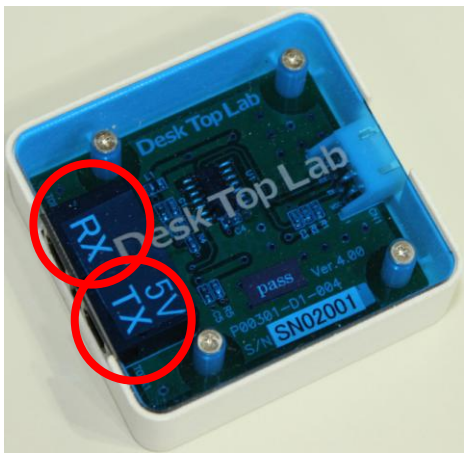


図 5-4 Target I/F unit

図 5-5 Target I/F unit

5.4 Connect the target CPU and the target I/F unit

5.4.1 Electrics specification

Connect 4pin connector of the target I/F unit to the target CPU. If the 5V I/O CPU, please use 5V version of the target I/F unit. If the 3.3V I/O CPU, please use 3.3V version of the target I/F unit.

Figure 5-6 5V version of the target I/F unit

Table 5-1 4pin connector

Connector	Pin number	function	Note
XH 4pin (JAE)	1	Vcc	
	2	To CPU の TXD port	
	3	To CPU の RXD port	
	4	GND	

Table 5-2 5V version specification

Item	MIN	Typ	MAX	Note
Vcc voltage	4.75V	5.00V	5.50V	
Icc		17mA	40mA	
High level input voltage	2.0V		Vcc	
Low level input voltage	0V		0.8V	
High level output voltage	3.5V	-	-	Vcc=4.75V, Ioh=-150uA
Low level output voltage	-	-	0.4V	Vcc=4.75V IoL=2.0mA

Table 5-3 3.3V version specification

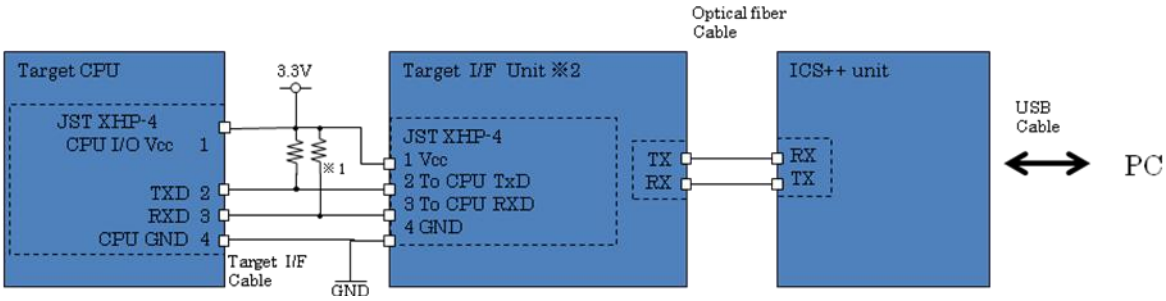
Item	MIN	Typ	MAX	Note
Vcc voltage	3.0V	3.3V	3.6V	
Icc		17mA	40mA	
High level input voltage	2.0V		Vcc	
Low level input voltage	0V		0.8V	

High level output voltage	2.4V		-	Vcc=3.0V, Ioh=-24mA
Low level output voltage	-	-	0.55V	Vcc=3.0V IoL=24mA

5.4.2 Example of the terminal connections

TXD / RXD pin of the target CPU need to connect approximately 10kΩ～47kΩ pull up resister to the same voltage as the I/O pins.

5.5 Examples of the ICS++ unit, target I/F unit and target CPU



※1: TXD and RXD pin need to pull up by around 10kΩ to 47kΩ resister.

※2: When you use 3.3V I/O CPU, please choose 3.3V target I/F unit.

When you use 5V I/O CPU, please choose 5V target I/F unit.

6. Caution

6.1 About ICS++ support CPU

Note on the use of ICS++ is shown below.

ICS++ can be used in the most of 16bit/32bit RENESAS CPU.

At December 18, 2014. The only RL78G1G cannot use ICS.

Please ask Desk Top Laboratories, if you want use dedicated CPU.

6.2 How to calculate the communication clock frequency of the ICS++

6.2.1 The case of RX62T

As a library that supports the ICS++ function in RX62T, there are the ICS library and ICS++ library.

A) The case of ICS library

When modifying the CPU clock, you need to set clock frequency in the ICS++ PC software.

Setting ⇒ Communication Settings

This clock frequency need to calculate following equation,

$$Clock_frequency = PCLK / 6$$

ICLK	PCLK	Clock frequency
80MHz	40MHz	6.667MHz
96MHz	48MHz	8MHz (Default)
100MHz	50MHz	8.333MHz

B) The case of ICS++ library

How to calculate the clock frequency is the same as the ICS libray.

7. Homepage and Support

7.1 Support

Desk Top Laboratories Inc Homepage

http://desktoplab.co.jp/

Contact
saka@desktoplab.co.jp

8. Revision

Rev.	Date	ICS++ PC software Version	Page	
1.03EN	2014.12.29	Ver.1.00.00		First release
1.05EN	2015.11.10	Ver.1.00.00		Add CPU list that works on ICS system
				-
				-
				-
				-
				-
				-
				-
				-
				-

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